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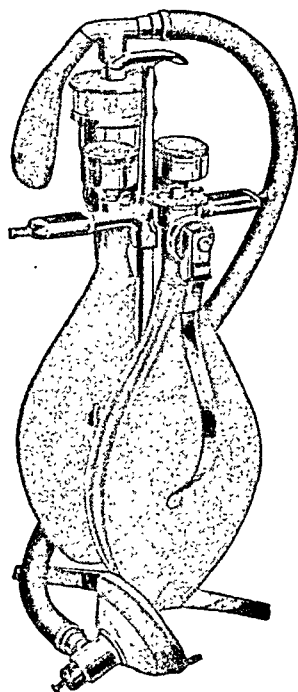
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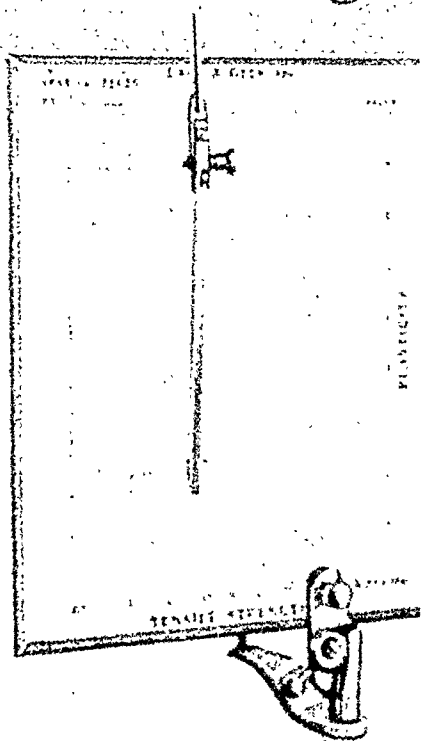
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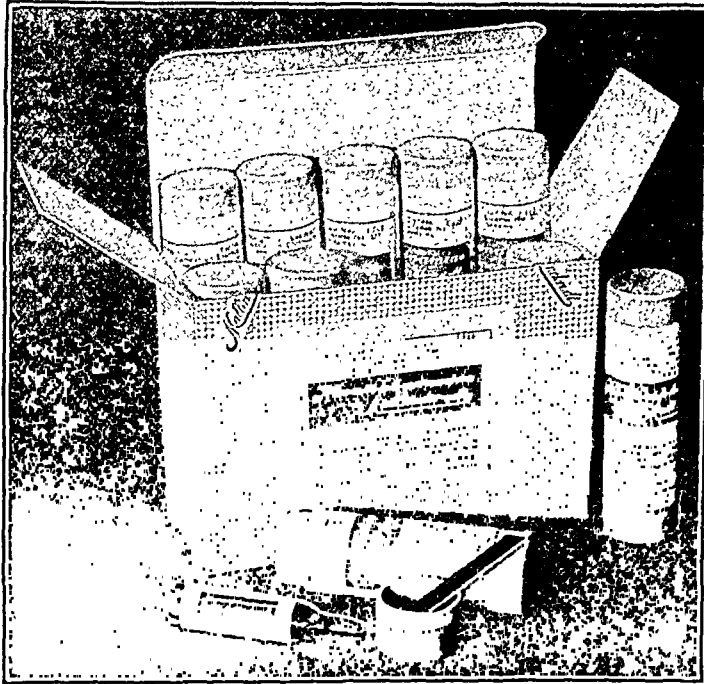
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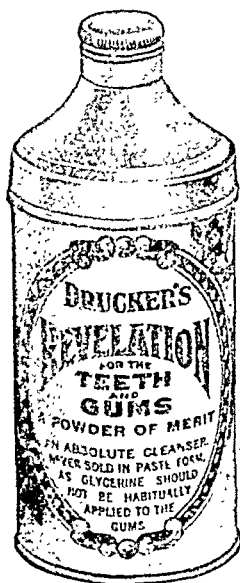
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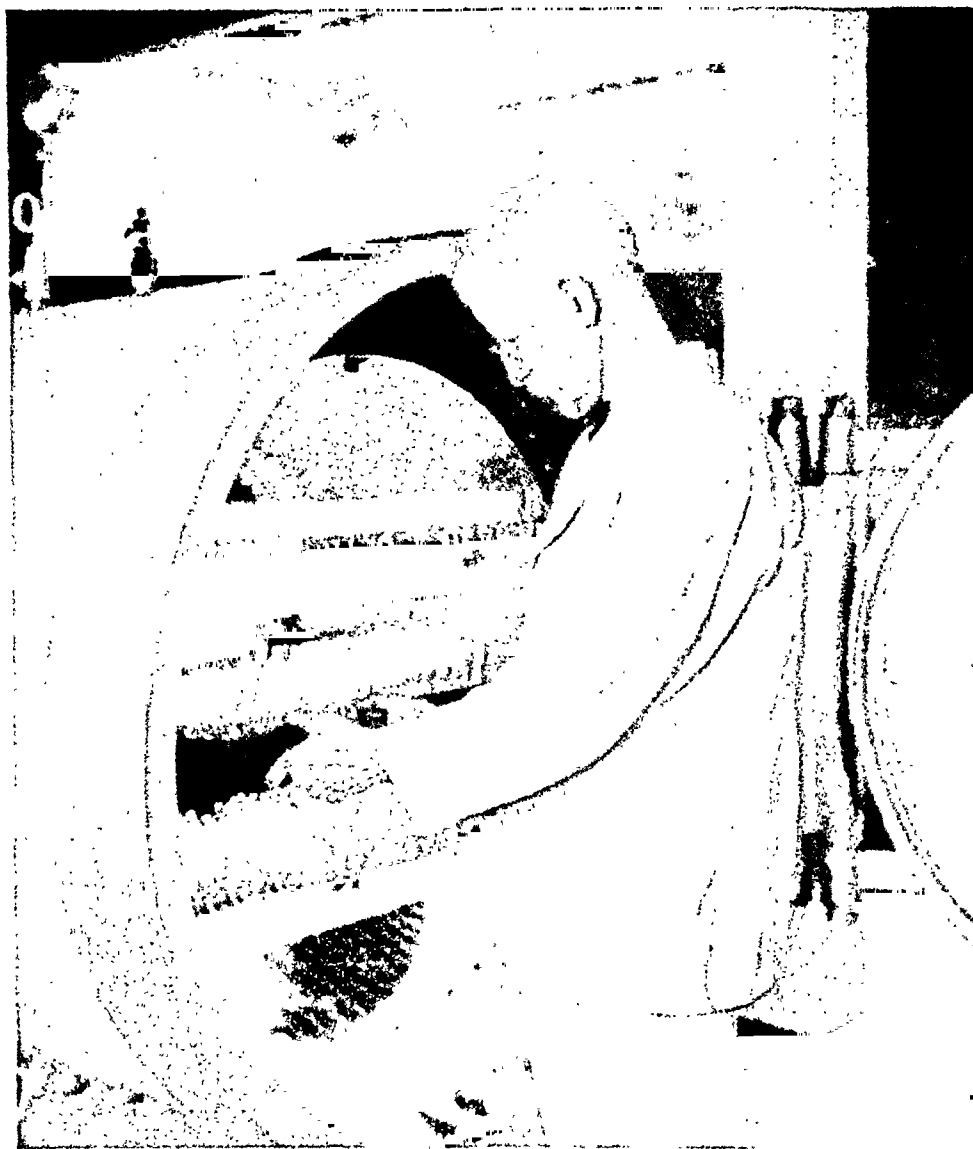
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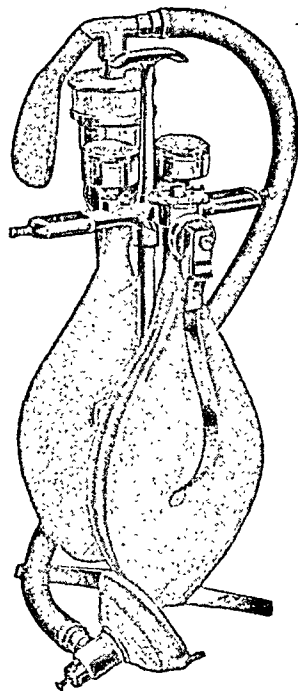
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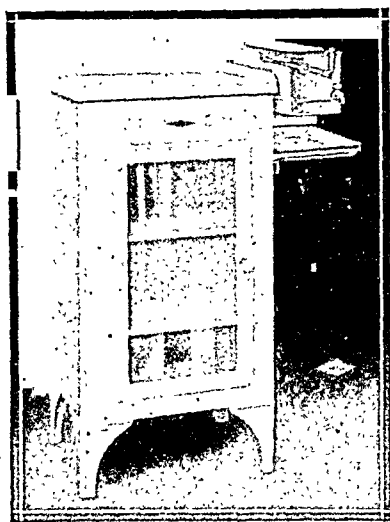
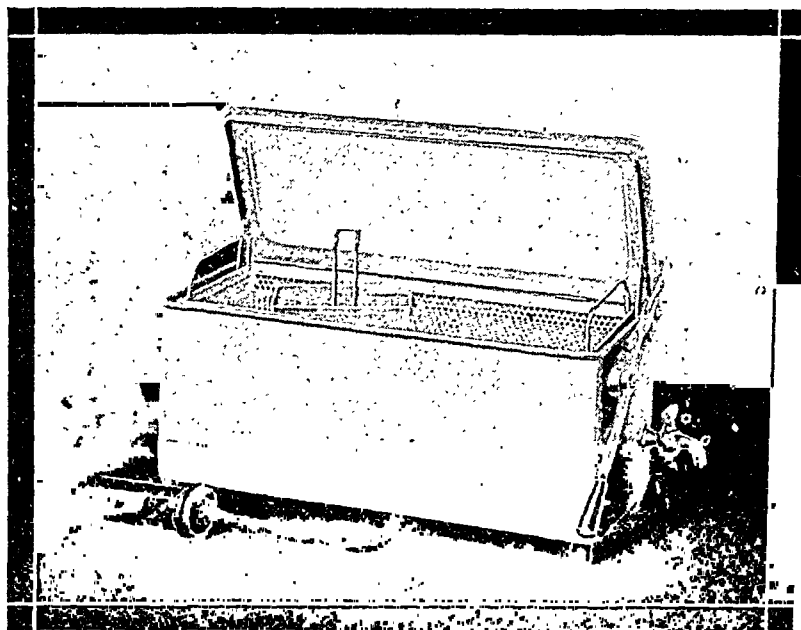
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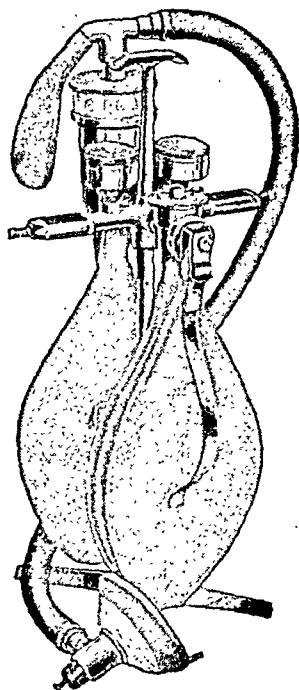
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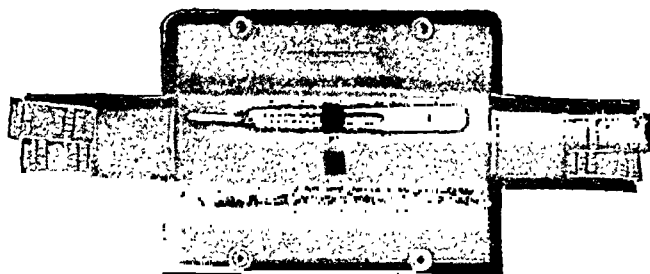
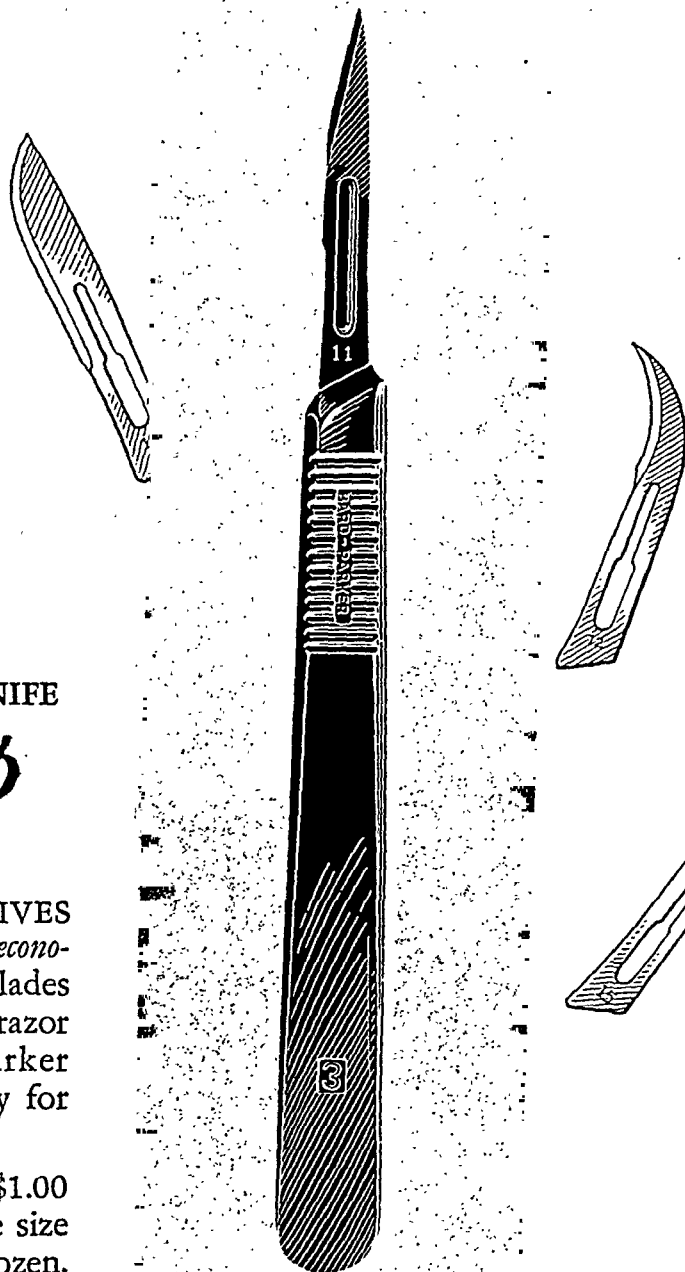
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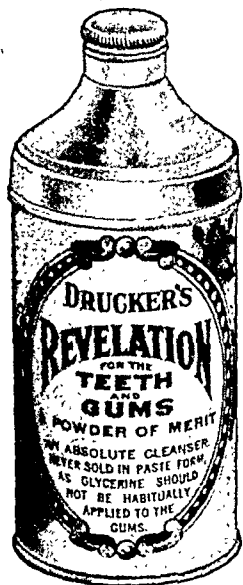
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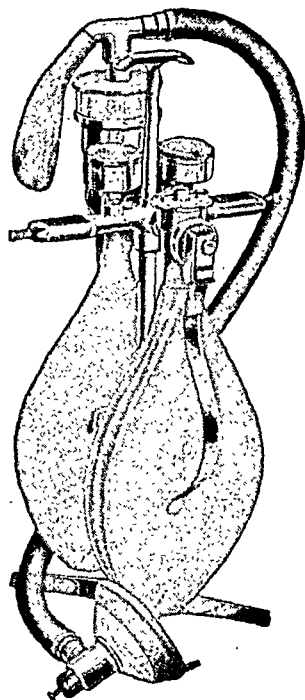
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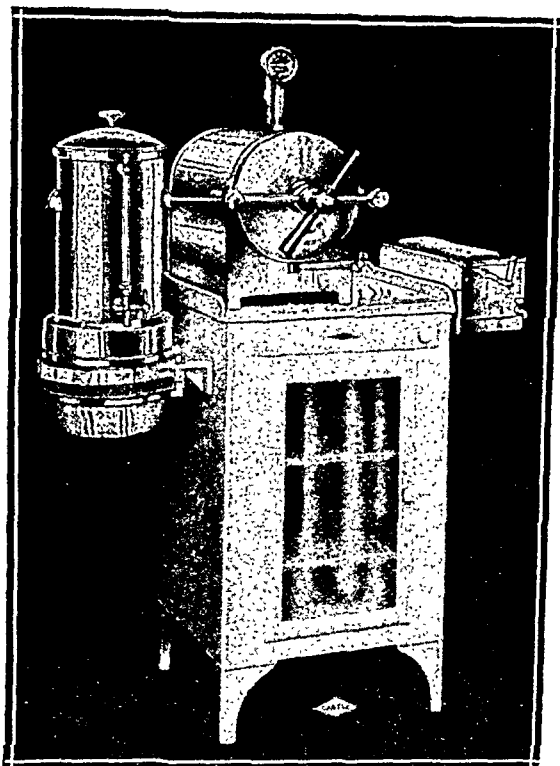
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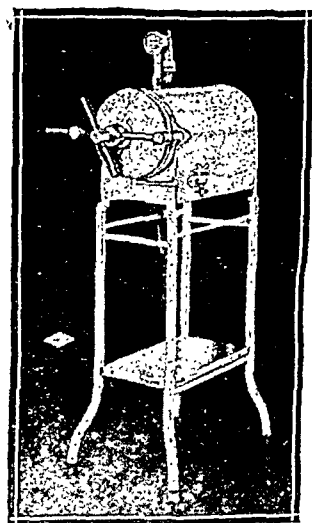


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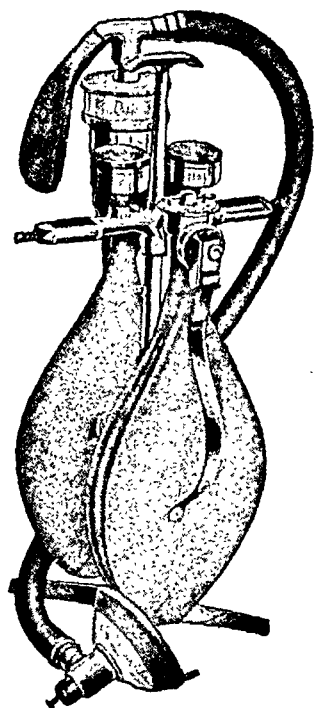
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# The American Journal of Obstetrics and Gynecology

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ST. LOUIS, JANUARY, 1928

No. 1

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## Original Communications

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### EPIDERMIDALIZATION OF THE CERVIX UTERI AND ITS RELATION TO MALIGNANCY

By C. F. FLUEHMANN, M.D., C.M., SAN FRANCISCO, CALIF.

*(From the Department of Obstetrics and Gynecology, Stanford University School of Medicine)*

FEW tissues of the body present such remarkable and varied reactions to pathologic stimuli as do the epithelial elements of the cervix uteri. Of prime importance among these are the processes which lead to a substitution of the cylindrical epithelium by a type of stratified squamous epithelium. These changes have been recognized for a long time but have received many interpretations and have been designated under a variety of names. The most descriptive of these is "epidermidalization" or, when the resultant tissue presents atypical characteristics, "epidermoidalization." Since the exact nature of the process is undetermined, the use of the term "metaplasia of cylindrical epithelium" and the incorrect interpretation of "stratification of cylindrical epithelium," which refers to a different change, should be discouraged.

#### EPIDERMIDALIZATION

The simplest way to describe this process is to regard it as representing a series of progressive changes by which the normal high cylindrical epithelium of the surface of the cervix uteri becomes substituted by a stratified squamous epithelium similar to that of the portio. In the first stage, there appears beneath the cylindrical cells and above the basement membrane of the mucosa a single row of new and distinctive cells (Fig. 1). These are small, polygonal in shape, stain deeply, and the nuclei are round or oval and somewhat large in

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proportion to the size of the cell. They are regularly arranged, and their general appearance at once suggests the basal-cell layer of stratified squamous epithelium. In the next phase, there is a proliferation of these infraepithelial cells until they form a stratified layer, varying from two to eight or more rows, which raise the cylindrical epithelium from its basement membrane (Fig. 2). (The resultant picture must not be confused with artefacts that may result from sections of cylindrical epithelium which have been cut obliquely and simulate a stratification of cells.) In this proliferation, there has been no change in the character of the individual cells. Mitotic figures are not seen.



Fig. 1.—Epidermidalization. Single and double rows of small polygonal cells undermining normal cylindrical epithelium. (High power.)

The cylindrical epithelium has remained unchanged, but from now on it is deprived of proper nutrition, and there results a degeneration of its component cells so that they become completely cast off. The proliferating infraepithelial cells then undergo a process of differentiation (Fig. 3). The cells near the surface become larger, their outlines more distinct, the cytoplasm does not stain as deeply, and they assume a rectangular shape so that the resultant tissue is not unlike the transitional epithelium of the bladder and urethra. The lowermost cells, which represent the active proliferating portion, remain small and polygonal. The cells at the surface finally become longer and more flattened, and the differentiation progresses to the point where we find normal stratified squamous epithelium with its three distinct layers.

Epidermidalization occurs not only on free surfaces but also deep in glands, the proliferating cells rapidly extending beneath the cylindrical epithelium from one point to adjoining areas. Many extraordinary and unusual pictures may be presented by the various transitional phases. This is particularly true when the process occurs in glands, where the proliferating cells may form irregular masses which project into and even completely fill the lumen. At times certain cells capable of forming mucus become incorporated in the tissue, and as they become overdistended with secretion, small cavities, the contents of which show positive stains for mucin, appear among the layers of cells. There may also be a degeneration of some cells, re-



Fig. 2.—Later stage of epidermidalization. Stratification of infraepithelial cells. (High power.)

sulting in small, partly necrotic areas. The resultant tissue then has a peculiar "fenestrated" appearance. This change has been designated by certain writers as a "mucoid degeneration," and Carl Ruge II<sup>1</sup> described a somewhat similar picture which he considered as a stratification of cylindrical cells occurring in infected cervical glands during pregnancy. Figs. 4 and 5 are sections of two glands from a mucous polyp of the cervix, showing various unusual forms which may be included under the term "epidermoidalization."

#### INCIDENCE

In order to determine the incidence of this phenomenon a study of 1280 slides, obtained from 1195 consecutive specimens of the cervix uteri, was undertaken. In this series a total of fifty-nine instances of

epidermidalization in various stages was noted, but in this number are not included thirty-five cases in which fully mature and normal squamous epithelium was found to be present within cervical glands. Figures for comparison could be obtained from only one source in the literature. Schottlaender<sup>2</sup> in 1912, in a study of 579 uteri, found these so-called metaplastic changes forty-seven times, thirty-three of which were in the cervix and fourteen in the body of the uterus.

An analysis of our fifty-nine specimens showed that in every instance there was a well-marked inflammatory process in the cervix. In fifty cases epidermidalization was occurring not only at the surface but also in the glands. Furthermore, in forty-one instances the pic-



Fig. 3.—Epidermidalization. Transitional type of epithelium to left of picture. Undetermined cylindrical epithelium on the right. (High power.)

ture presented was that of an erosion of the cervix in various stages of healing. It was thus apparent that in adults the phenomenon occurred as the result of a definite irritation in the form of an inflammatory reaction.

A few specimens of the cervix from newborn children were then obtained, and two of these definitely showed various transitional phases of epidermidalization in the cervical canal. This is in keeping with the work of R. Meyer<sup>3</sup> on pseudoerosio congenita, and Carl Ruge I,<sup>4</sup> in 1918, explained that the process of differentiation from cylindrical to stratified squamous epithelium on the portio was not completed at birth and that in many instances the various transitional phases could be demonstrated.

The most fertile field, however, was found in mucous polypi of the

cervix. In a previous study,<sup>5</sup> one hundred pathologic specimens of this condition were carefully analyzed, and in twenty-nine cases, epidermidalization was found occurring in localized areas on the surface of the polyp and involving the glandular elements. These areas most frequently were noted at the tip of the polyp when the base invariably showed normal cylindrical epithelium. Several of these specimens demonstrate very completely the whole process of epidermidalization in its various phases, and most of the illustrations for this article were obtained from sections of mucous polypi.

Although this paper is solely concerned with epidermidalization of the cervix, brief mention must be made here of the numerous refer-



Fig. 4.—“Epidermoidalization.” Dilated gland in a cervical mucous polyp almost filled with atypical squamous epithelium, showing “mucoid” areas and areas of degeneration. (Low power.)

ences in the literature to a similar occurrence in the endometrium and in endometrial polypi. In this situation, it may present the various transitional stages described above (Herxheimer,<sup>6</sup> Sitzenfrey<sup>7</sup>). It has been found in the uterine body of a newborn infant (R. Meyer<sup>8</sup>) and of young children (Friedländer,<sup>9</sup> Hoehl,<sup>10</sup> Natanson<sup>11</sup>). In adults it is comparatively rare but has been described several times (Hengge,<sup>12</sup> Klein,<sup>13</sup> Sitzenfrey<sup>7</sup>). It has been associated with a pyometra (Bondi<sup>14</sup>), with tuberculosis of the uterus (Alterthum<sup>15</sup>), and with hyperplastic endometrium (Hunziker,<sup>16</sup> R. Meyer<sup>17</sup>), and Opitz,<sup>18</sup> and Herxheimer<sup>6</sup> have described epidermidalization on the surface of endometrial polypi projecting into the cervical canal. Finally, it has been found associated with adenocarcinoma of the body of the uterus,

and its relation to primary squamous cell carcinoma of the uterine body has been discussed by many authors (von Rosthorn,<sup>19</sup> E. Meyer,<sup>20</sup> Maunu af Heurlin,<sup>21</sup> Hitschmann,<sup>22</sup> Schauenstein<sup>23</sup>).

#### THEORIES

The simplest explanation for the origin of the infraepithelial cells, which play such a vital part in epidermidalization, is that they represent an ingrowth of basal-cells from adjacent normal squamous epithelium. Eichholz,<sup>24</sup> as a result of his researches on metaplasia, suggested that this was the most likely means of production. Frankl<sup>25</sup> is also in favor of this assumption, especially where we are concerned

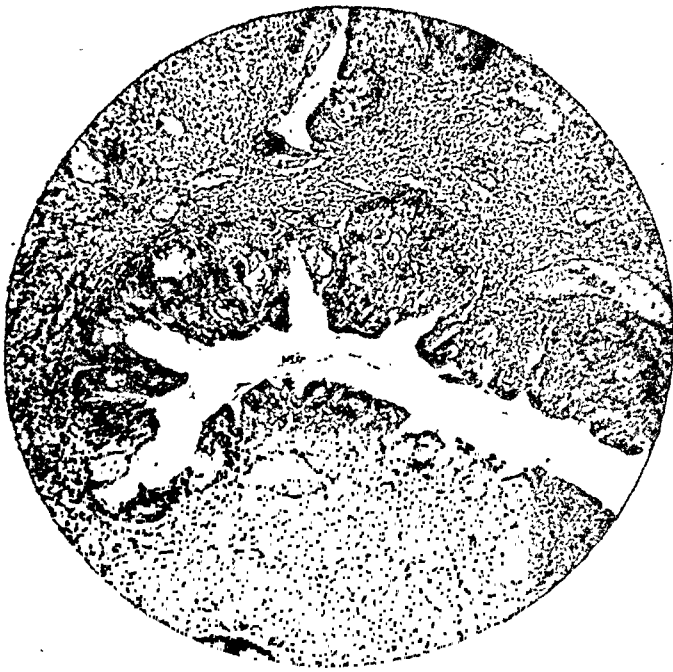


Fig. 5.—Gland in a cervical mucous polyp showing "epidermoidalization." (Low power.)

with the changes deep in the cervical glands, and R. Meyer,<sup>26</sup> in his theory of cervical erosions, gives this explanation for the process of healing.

The picture of normal stratified squamous epithelium growing into a cervical gland by direct extension and without a transitional stage is a very familiar finding, while in many instances of epidermidalization, a connection can be traced between the infraepithelial cells and the basal layer of adjacent squamous epithelium. It is thus very likely that we have here at least a frequent mechanism for the substitution of the cylindrical epithelium. However, it is insufficient to account for the occurrence of epidermidalization in three specific cases. It has been mentioned previously that squamous epithelium can often be found at the tip or lateral surfaces of a mucous polyp, when the

base of the polyp is totally covered by cylindrical epithelium and, therefore, no direct connection with the squamous epithelium can be established. Again, the occurrence of islands of epithelial cells showing epidermidalization and which are completely isolated has been frequently noted. Finally, the fact that it may occur primarily deep in a gland argues against the possibility of explaining epidermidalization solely on the basis of an ingrowth from adjoining tissues.

The work of R. Meyer<sup>25, 26</sup> (Adair<sup>25</sup>) on the development of the epithelial covering of the cervix and his theory for the formation and healing of erosions is well known. He has shown that early in fetal life (third to fourth month) the undifferentiated cellular covering of the portio develops into squamous epithelium which extends high up into the cervical canal. At about the sixth month, cylindrical epithelium appears, which gradually forces the squamous epithelium out of the cervical canal. In this transition, a certain number of basal cells are left beneath the cylindrical epithelium, where they remain latent until some future time when under the influence of an external stimulus there is a weakening of the cylindrical epithelium. The rests of basal cells then begin to proliferate and result in a substitution of the cylindrical cells by a stratified squamous epithelium. According to R. Meyer, this accounts for the epidermidalization of polypi, healing of erosions, etc.

Are we concerned here with a metaplasia of cylindrical epithelium? The term has been frequently applied to these changes, but it is sometimes hard to determine if the word is used to imply simply a *substitution* and not a direct *conversion* of one tissue into another. The problem is whether the cells concerned in epidermidalization are derived directly from mature cylindrical epithelial cells. Considerable attention was devoted to this question by Kaufmann<sup>29</sup> and Oeri<sup>30</sup> in 1906, and they came to the conclusion that the infraepithelial cells concerned represented various transitional phases of a metaplastic process. However, many observers, notably Eichholz,<sup>21</sup> R. Meyer,<sup>26, 27</sup> Frankl,<sup>25</sup> Geller,<sup>31</sup> are very much opposed to the conception that this represents a true metaplasia.

It has also been suggested that there might be a direct implantation of squamous epithelium on a mucous polyp projecting from the external os and thus account for this type of epidermidalization. It is a possibility, but one which would be so limited by exceptions that, as R. Meyer<sup>27</sup> states, it is scarcely acceptable.

Another possible explanation, which has been mentioned, rests on the belief that certain embryonic undifferentiated cells may persist as inclusions in cylindrical epithelium. These units would contain in themselves the potentialities of developing into either type of tissue and would mature into squamous epithelium following a pathologic

stimulus, such as inflammation. Eichholz<sup>24</sup> and Geller<sup>31</sup> both mention this possibility. The theory, of course, requires for its support that the presence of such cellular inclusions be demonstrated. R. Meyer<sup>3</sup> found certain small cells occurring beneath the cylindrical epithelium, but in conformity with his theory, he considers them as representing rests of basal cells from squamous epithelium which previously covered that surface, and he does not see any reason for attributing a two-fold power of differentiation to them.<sup>27</sup> Krompecher,<sup>32</sup> as a result of his basal-cell studies, maintains that cylindrical epithelium has a basal-cell layer. These cells are of an embryonic character and may differentiate into a squamous epithelium. Such a process he would term dysplasia, or "regenerative dysplasia." Schmidt,<sup>33</sup> in a study of the regeneration of cylindrical epithelium of the cervix uteri, attached considerable importance to certain small round cells, with clear protoplasm, which are almost constantly seen among the cylindrical cells of the mucosa. He does not believe that they are wandering cells or leucocytes but that they are important factors in regeneration and are found in large numbers in rapidly growing polypi, erosions, etc. The problem is an interesting one and offers an attractive field for future work.

#### RELATION TO MALIGNANCY

The changes incident to epidermidalization have been studied for a very long time, and a review of the literature shows that various interpretations have been placed upon them, many of the older writers considering them as early malignancy. This is particularly true in regard to findings on cervical mucous polypi. In several cases these tumors were reported as showing early carcinomatous degeneration, notably by J. Williams,<sup>34</sup> Keitler,<sup>35</sup> Kroemer,<sup>36</sup> and Bulius.<sup>37</sup> The interpretation given by these writers has received considerable criticism from subsequent workers, who have maintained that insufficient evidence of malignancy has been brought forward and that it is more likely that they were concerned simply with epidermoidalization. Similar findings were described by Küstner,<sup>38</sup> Benthin,<sup>39</sup> Kaufmann,<sup>29</sup> and Oeri<sup>30</sup> and considered by them as representing purely benign conditions. In his book on *Cancer of the Uterus*, page 338, Cullen<sup>40</sup> gives an illustration, showing cylindrical epithelium both on the surface and within cervical glands undermined by cells, apparently an early phase of epidermidalization. He says, in regard to the finding, "I am entirely at a loss to explain just how this condition is produced, but have not the slightest hesitancy in saying that it is benign." Finally, more recent writers maintain that many cases of epidermoidalization are to be looked upon in the light of precancerous lesions (Stone,<sup>41</sup> Geller,<sup>31</sup> L'Esperance<sup>42</sup>).

It is very evident from what has been said regarding epidermidal-

ization that we are not concerned here with a malignant change. However, it is of vital importance to realize that atypical forms of the process may lead to confusion with carcinoma. Such confusion in the vast majority of instances will arise in those cases in which only a small biopsy specimen is available or where single sections have been cut at oblique angles and so yield a distorted picture. The error may occur in one of two ways: first, a specimen in which epidermidalization has resulted in an excessive proliferation of the cellular elements and the formation of atypical growths may present findings which at first sight very closely simulate malignancy; secondly, an early carcinoma or a section taken from the edge of a newgrowth

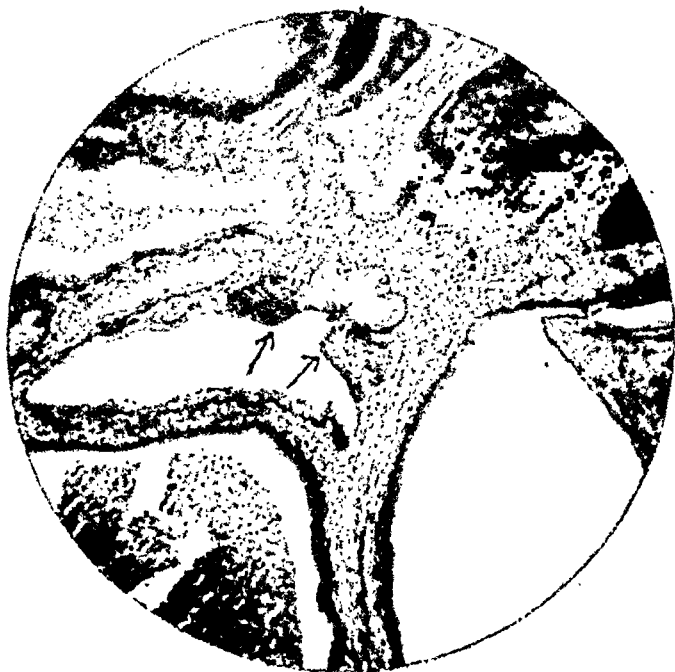


Fig. 6.—Cystic glands of the cervix uteri, one of which shows presence of cancer cells in two places. (Low power.)

may show such maturity of the constituent cells that it may be interpreted as epidermidalization.

In both instances the differential diagnosis is established by a very careful survey to ascertain the presence or absence of the so-called criteria of malignancy. These criteria have been enunciated by Schauenstein,<sup>43</sup> Pronai,<sup>44</sup> Rubin,<sup>45</sup> and Ewing,<sup>46</sup> and in this particular problem special attention must be paid to the following points of differentiation:

1. Atypical properties of individual cells. In carcinomatous tissue the cells present many irregularities; the cellular outline becomes indistinct while the protoplasm usually stains intensely; the nuclei are large, irregular, stain more deeply, show vacuolization and decay of nuclear substance, stand in no regular order with one another, and



are here and there gathered into clusters, and usually show atypical and asymmetrical mitotic figures.

2. Differentiation of tissue. It is here that epidermoidalization presents many difficulties. Although cancers of the cervix invariably show no regular stratification and are characterized by a richness in number of cells which lie closely pressed together, there are some slow-growing mature tumors which present fairly successful attempts to reproduce stratified squamous epithelium. Conversely, some cases of epidermidalization show masses of cells which have not assumed a regular stratified formation. Of considerable importance in this regard is a study of the basal-cell layers. In carcinoma the basal cells



Fig. 7.—High power microphotograph of Fig. 6, showing cancer cells in wall of cervical gland.

invariably present an irregular arrangement and lie obliquely or transversely to the surface of the tissue, whereas in epidermidalization they more consistently lie in normal parallel lines.

3. Invasive and destructive properties of the proliferating cells. If at any point in a doubtful case definite invasion of the proliferating cells into surrounding tissue can be demonstrated, then there is no doubt that we are dealing with a malignant lesion. Schauenstein<sup>43</sup> has shown that cancer cells develop along the paths of least resistance, first extending along glands (Figs. 6, 7, 8) and then breaking out into adjoining tissues. If, however, no invasion can be demonstrated, we are still faced with the possibility of a very early carcinoma. In epidermidalization the cells are always limited to the glands, but artefacts due to sections cut across the fundus or sinuosities of a

gland may reproduce the picture of small nests of cells invading the surrounding tissues. Such findings must be carefully studied by serial sections in order exactly to determine their nature.

The finding of epithelial "pearls" has been considered a very valuable sign of malignancy, and Cullen<sup>17</sup> even states, "We have never seen an epithelial pearl in the squamous epithelium of the cervix except in cases of squamous cell cancer of this region." Although the demonstration of a pearl may be of some value in the question of diagnosis, its presence is not to be considered as pathognomonic for malignancy. Among the 1280 slides of the cervix that were studied in the



Fig. 8.—Cancer cells invading cervical gland. (Low power.)

preparation of this paper, four instances were found of epithelial pearls in normal or hypertrophied squamous epithelium occurring in specimens which showed inflammatory lesions and nothing suggesting a malignant change (Figs. 9 and 10).

In a masterly review of the subject of epidermidalization, R. Meyer<sup>27</sup> has called attention to another angle of the question, namely, that the stratified cells of epidermidalization must be differentiated from those occurring in a stratification of cylindrical epithelium. Although the latter may occur in inflammatory lesions of the cervix, it is much more marked and more frequent in carcinoma. The lower cell layers may be confused with the basal cells of squamous epithelium, although the latter are generally polygonal, while the proliferating cylindrical cells maintain their cylindrical form. In this connection, special stains to

demonstrate the presence or absence of mucin in the proliferating cells may be of considerable value.

Whenever sufficient tissue which has been properly sectioned at right angles to the mucous surface is obtainable, the differentiation between carcinoma and epidermidalization can invariably be made after a careful study. This has been the experience with the specimens available in the Stanford series, but a few of these show certain atypical formations, which, although they cannot be classified as definitely malignant, lead one to discuss whether they should be labelled with the term "precancerous." Here we are met with the problem of defining what is meant by "precancerous." A study of the literature shows that it is applied to a great variety of lesions of the cervix,



Fig. 9.—Epithelial "pearl" in noncancerous squamous epithelium of the cervix. (Low power.)

both clinical and pathologic. Since it has become generally accepted that chronic cervicitis is a frequent precursor of cancer, all severe inflammations of the cervix are often referred to as "precancerous," irrespective of the fact that in reality only a small percentage of these cases go on to malignancy. Ewing<sup>40</sup> states, "Precancerous diseases in themselves possess not a single essential element of the cancerous process," and L'Esperance,<sup>42</sup> "I believe that a precancerous lesion is only a potential carcinoma; some but not all go on to develop cancer."

From this standpoint many specimens showing epidermidalization could be considered as precancerous, because this lesion is so often found in connection with severe chronic inflammatory processes. But

here we are interested in the question from a more definite point of view. Cancer of the cervix develops from one or the other of its two epithelial tissues—cylindrical epithelium or stratified squamous epithelium. In epidermidalization, we find not only both these tissues but certain cells of a more immature type which represent a transition from one to the other. It is thus perfectly reasonable to assume that a cancer may develop from these elements. If this is so, is cancer more likely to develop from the cells of epidermidalization than from the normal epithelium of the cervix? Given two series of patients, one presenting evidence of epidermidalization and the other simply of chronic cervicitis, which will show a higher incidence of cancer? And finally, do those cases of epidermoidalization, where

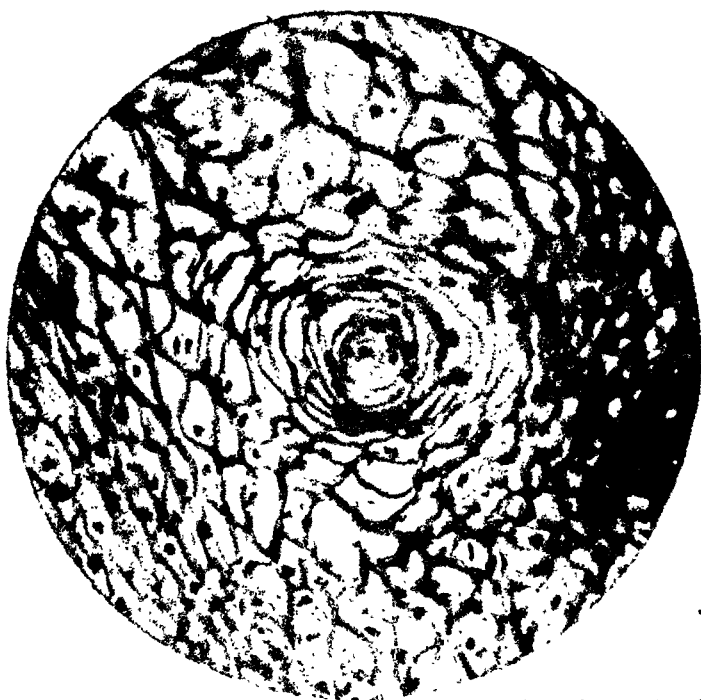


FIG. 10.—High power microphotograph of Fig. 9.

there is an excessive proliferation of the cells and the presence of atypical formation, necessarily represent a transition from a benign to a malignant condition?

Several authors are of the opinion that excessive proliferation of the cells concerned in epidermidalization may lead to carcinoma, and that at times this proliferation may actually represent a transition from a benign to a malignant condition. In 1906 Oeri<sup>30</sup> analyzed in detail a cervical mucous polyp showing epidermidalization, and although he considered it as representing a benign metaplastic process, he expressed his belief in the possibility of malignancy developing at a later date. Stone<sup>41</sup> in 1916 gave an excellent review of the subject of so-called precancerous conditions of the uterus and pointed out

that although the evidence was too scanty to confirm or deny the histogenetic relations between definite benign lesions and cancer, he was inclined to regard many of the findings of epidermidalization as representing phases in the transition towards a malignant growth. Geller<sup>31</sup> felt that they should be regarded as having malignant tendencies even if the histologic picture did not demonstrate this conclusively, because we are concerned with epithelial growths which have developed from undifferentiated cells after a long latent period, also because there is a disturbance of the normal tissue relations, and finally because there is nothing to assure us that the proliferation will in time come to a standstill. L'Esperance<sup>42</sup> believes that when epidermidalization occurs as the result of prolonged irritation, "it is in this relation to inflammation that it most frequently enters the picture of the precancerous process."

Considerable work has been done on this problem by R. Meyer.<sup>27</sup> who has studied with special care the patients who presented doubtful findings. Many of these have been closely watched, and in his opinion epidermoidalization in cases of hyperplasia and inflammation of the cervix is almost always benign. Ulesco-Stroganowa<sup>48</sup> believes that when atypical growths suggesting malignant hyperplasia are found in the cervix, the diagnosis of cancer is not justified if they can be explained as resulting from an active process, such as gonorrhea, erosions, syphilis, tuberculosis, etc. It is more logical to treat the primary condition and keep the patient under close observation than have her submit to an extensive operation. Frank<sup>49</sup> has called attention to the questionable diagnosis of "beginning cancer" in lesions which may as well turn out to be harmless epithelial proliferations, and the abuse of such conceptions which lead to radical operations solely "on suspicion."

The answer is difficult to find, for apparently no large series of patients who showed epidermidalization of the cervix and who did not have operative procedures has ever been systematically followed. None of the Stanford patients have ever returned with carcinoma of the cervix, but this evidence is of little value, as the material studied was obtained mostly from operative cases. However, the findings in mucous polypi are very suggestive, in that epidermidalization of these tumors is of frequent occurrence and malignancy comparatively rare. During the past fourteen years, only two cervical polypi showing carcinoma have been found at the Stanford Clinic. In only one of these is it certain that the change was in a definite, preexisting mucous polyp, and in both instances the cervix itself was involved. The incidence of epidermidalization, on the contrary, was found to be 29 per cent. Thus, it may be concluded that, at least as far as mucous polypi are concerned, epidermidalization seldom if ever leads to a malignant degeneration.

On the whole, epidermidalization is a purely benign local tissue reaction. At times it may lead to the formation of atypical growths which may be confused with an early carcinoma. A careful study of serial sections and repeated biopsies will invariably clear up the diagnosis. Very rarely cases are met with in which it is impossible to determine whether we are dealing with a benign hyperplasia or an early malignant change. These may be labelled "precancerous" and treated accordingly, but it is probable that the majority of even these will eventually prove harmless.

#### SUMMARY

By epidermidalization is meant a process by which the normal cylindrical epithelium of the cervix is replaced by a stratified squamous epithelium. Five theories have been suggested to account for the exact mechanism involved in this change. It was found to occur in fifty-nine instances of chronic cervicitis from a series of 1195 specimens of the cervix and in twenty-nine of 100 cervical mucous polypi. It was also noted in newborn cervixes, and there are many references in the literature to the finding of squamous epithelium in the endometrium.

At times the process may lead to the formation of atypical epithelial overgrowths, which may be termed "epidermoidalization." Careful study of serial sections and repeated biopsies may be necessary to differentiate these findings from an early carcinoma. In rare instances, malignancy can be excluded, but certain features are present which may be considered as "precancerous." It is not certain that these really represent transitions from a benign to a malignant growth, and there is reason to believe that most of them would probably prove to be harmless.

Due acknowledgment is made to Mr. Pierre Lassègues for the microphotographs used in this article.

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## A NEW OBSTETRIC FORCEPS\*

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THE anticipation of trouble during labor by the careful examination of patients during their pregnancies and at the onset of labor and the improvement of the technic of cesarean section has greatly reduced the incidence of difficult forceps operations. Though it is known that the amniotic sac becomes infected very soon after the rupture of the membranes, whether vaginal examinations have been made or not, the perfection of the low cesarean section by Beck, De-Lee, Latzko, and others has decreased the dangers of peritonitis so much that in borderline cases long trial labors can now be advised, resorting to one of these operations should failure occur. There is no question that the cesarean section is indicated when there is any bony obstruction and craniotomy, if the child has been seriously compromised. We are no longer justified in attempting difficult operations through the birth canal in such cases, when the high infant mortality and the injury to the mother are considered.

The actual misjudging of the size of the baby and pelvis, though it occasionally happens, does not play a large part in difficult labors. A greater proportion of these are caused by the malpositions of the

\*The completed instrument herewith described was first presented at a meeting of the New York Obstetrical Society, November 10, 1925.

child's head due to torsion or rotation of the uterus which are so frequently found in deformed pelves. The woman can usually overcome a moderate bony obstruction by her own forces and the resultant molding of the head, provided the head can be fitted squarely into the axis of the pelvis. This frequently can be done by binders and by changing the position of the patient during labor. If the presenting part does not adapt itself to the inlet, allowing the head to act as a ball valve, early rupture of the membranes is common with a



Fig. 1.—Barton forceps assembled.

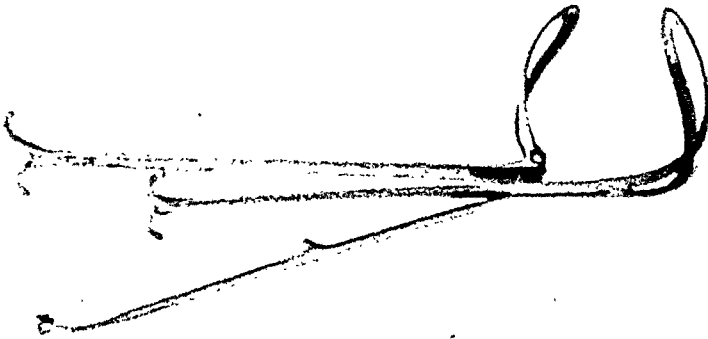


Fig. 2.—Farabeuf cephalometer.

resultant long and difficult labor. The use of the De Ribes or Voorhees bag is often necessary to complete the dilatation of the cervix. After dilatation of the cervix, combined manipulations from above and below permit correction of the malposition, though failure to do this has occurred earlier in labor. Unfortunately, secondary uterine inertia frequently occurs with the head still high in the pelvis and above the brim. Under such condition, with no bony obstruction and with the soft parts out of the way, version or forceps can be resorted to rather than cesarean section. It is in such cases that the Barton



forceps are frequently of great use. The mortality for the mother in cesarean section is still so high that we feel that a thorough study of the mechanism of labor is of value.

While at the present time, there are a number of different types of obstetric forceps which may be successfully employed in low forceps and midforceps operations, no one of them, however, in high forceps operations is equally efficient. This is due to the fact that the forms of the various forceps, as now constructed, render them not equally well adapted to both the head and the pelvic axis except in the low positions and necessitate, in the high forceps operation, the adoption of either the pelvic or cephalic methods of application. As a result of this lack of simultaneous adaptability in the pelvic method of ap-

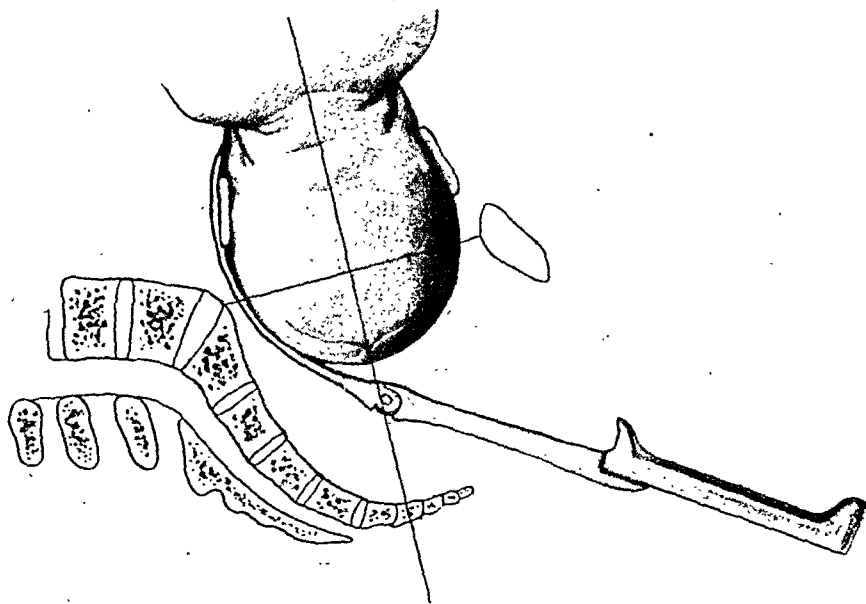


Fig. 3.—Introduction of anterior blade in midline posteriorly.

plication, the relation between the forceps and the head is faulty; in the cephalic application, the relation between the forceps and the pelvic axis is faulty.

With both the pelvic and cephalic methods of application, certain unfavorable conditions are associated, which may be stated as follows:

In the pelvic application, the grasp of the head by the blades is either over the face and the occiput, or over one brow and the opposite mastoid region, according to where the occipitofrontal diameter of the head lies in the transverse or oblique diameters of the pelvis and, as the cephalic curve of the blades is not well adapted to the surfaces with which they are in apposition, difficulty is experienced in locking the forceps; during traction, if the head becomes slightly extended, the blades are liable to slip; the line of traction is not coincident with the axis of the superior strait; normal rotation during descent is interfered with, and the compression of the head by the blades is in the least favorable diameter and is often followed by intracranial hemorrhage.

In the cephalic application, while the blades may be accurately applied over

the parietal bones, the long axis of the forceps is not coincident with the axis of the superior strait and results in a faulty line of traction; the head is tilted laterally toward the pubes, relatively increasing the size of the head in excess of the biparietal diameter (Figs. 8 and 9); during descent, the posterior blade bridges over the hollow of the sacrum and interferes with the entrance of the head into the pelvis.

In addition, many forceps have widely diverging blades in advance of the head which, unless great care is exercised, are the starting point of the serious lacerations. It should be evident, therefore, that it is not possible to apply any forceps, whose blades are parallel with the shanks, by either the pelvic or cephalic methods, but that the result will be a disturbance of the normal relation of the head to the pelvic

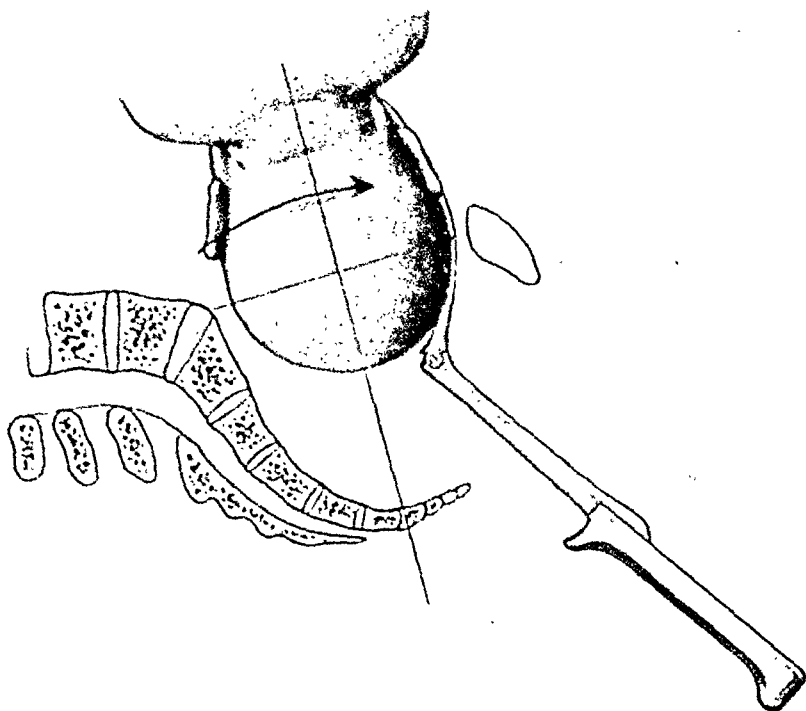


Fig. 4.—Anterior blade rotated to position in front of head.

axis by either a rotatory or lateral displacement, bringing longer diameters of the head in conjunction with shorter diameters of the pelvis, increasing the amount of traction force necessary to effect delivery and also the risk of undue compression of the head and injury to the structures of the parturient canal.

It is necessary, therefore, that forceps designed to avoid the above-mentioned conditions should possess certain qualifications, namely, their form should be such that they are adaptable to both head and pelvic axis at the same time, permitting a cephalic application without disturbing the normal relation of the head to the pelvis; they should have no widely diverging blades in advance of the head; they should, in no way, interfere with the normal mechanism of labor. The Barton forceps was designed to comply with these qualifications.

## DESCRIPTION OF FORCEPS

These forceps differ from the usual types in that the blades join the shanks at an angle, as shown in Fig. 1. This angle is the normal angle between the axis of the superior strait of the pelvis and the axis of the pelvic outlet. This construction permits an accurate cephalic application, in cases of arrest of the head at the pelvic brim, in either the transverse or an oblique diameter, without disturbing the normal relation of the head to the pelvic axis.

Owing to the peculiar shape of the anterior blade, for the purpose of application, it is necessary to incorporate a joint at the junction of the blade and shank. By means of this joint, the blade can be swung through an arc of a circle until it is nearly parallel with the shank, as shown in Figs. 3 and 4.

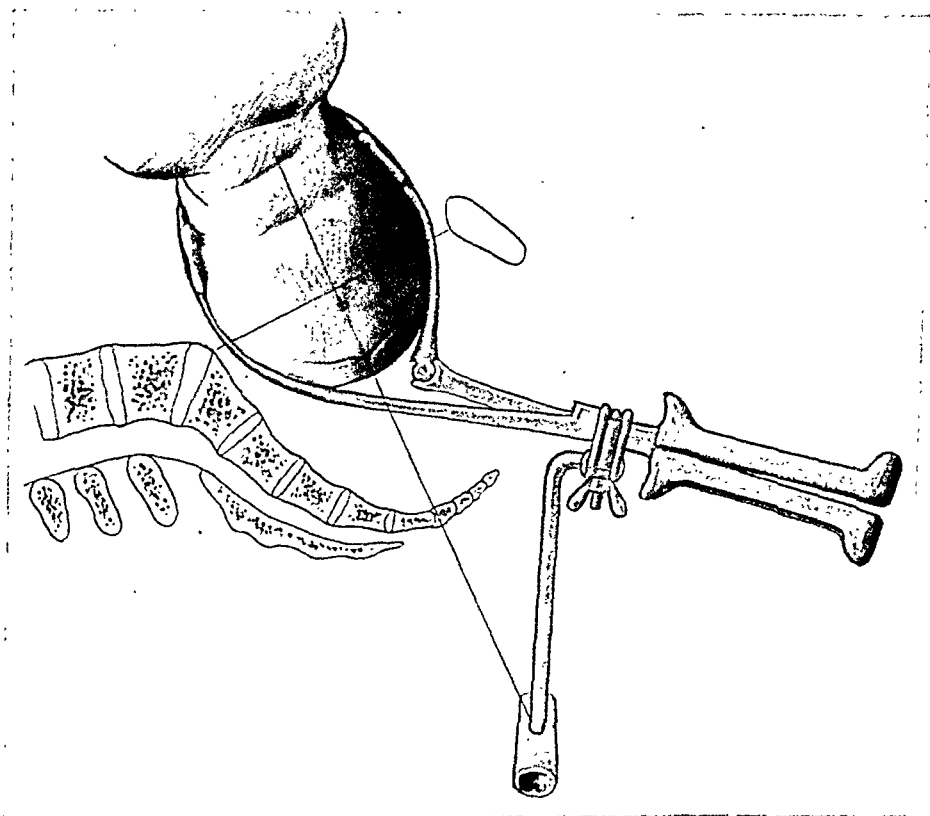


Fig. 5.—Posterior blade introduced, forceps locked, axis-traction rod attached. Note normal relation of head to pelvic axis and handle of axis-traction attachment in line with the axis of the superior strait.

The lock of the forceps is so constructed that a gliding motion of one member on the other is permitted; this insures the adaptability of the blades to heads of varying sizes without destroying the symmetry of the space between the blades.

The axis-traction attachment consists of the customary cross-bar handle pivoted on the end of the traction rod. The other extremity of the traction rod is pivoted to the yoke which partially encircles the shanks of the forceps. On one side of the yoke is a lug through which passes a tension bolt, the horizontal portion of the tension bolt lying in vertical slots on each side of the yoke. (Fig. 5.)

To apply the axis-traction attachment to the forceps, loosen the winged-nut sufficiently to permit the tension bolt to be raised from the vertical slots and rotated ninety degrees. Apply the yoke to the forcep shanks from below, rotate tension bolt to proper position for its horizontal portion to enter the vertical slots, and tighten the winged nut.

In order to apply and manipulate the Barton forceps properly certain conditions are essential; namely, an exact cephalic application should be made, as is determined by having the sagittal suture midway between the heels of the blades; the position of the shanks and handles in the vertical plane should be such that the axis of the blades is coincident with the pelvic axis; rotatory displacement of the head should be corrected by rotating the forceps on its long axis, to either right or left as required, in conjunction with a lateral movement of the handles in the horizontal plane in a corresponding direction; the relation of the blades to the head should be such that, during descent, flexion is encouraged and not antagonized; direct traction in a line with the shanks and handles should never be employed, but instead, a modified Pajot maneuver.

Dr. Barton got the idea of his instrument from observing that dentists used a different type of extracting forceps for the molars than for the incisors. He believed that we were attempting deliveries in

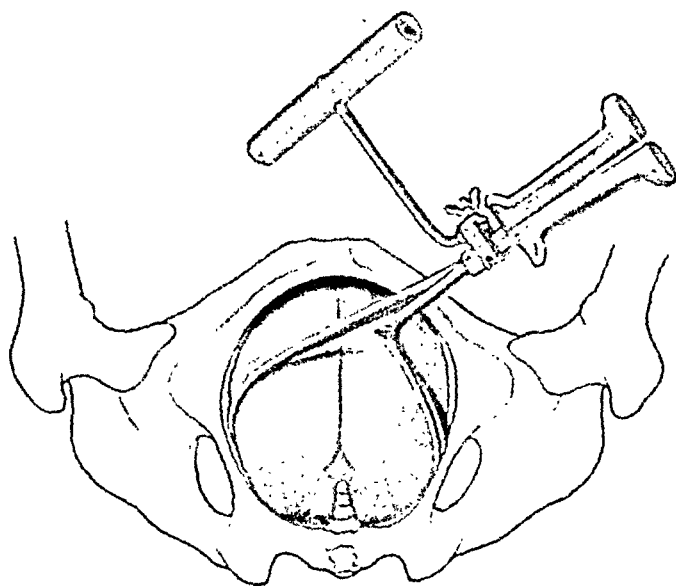


FIG. 6.—Rotation of head completed.

the upper pelvis with forceps which were designed for the lower pelvis and which could only be used to best advantage at this point. With the idea that there should be an entirely different principle in forceps intended for high application, especially in transverse and occiput posterior positions, he designed the instrument described in this article. Farabeuf had developed a similar instrument but only for the purpose of measuring the fetal head. Apparently, the possibility of such an instrument as a forceps did not occur to him. (Fig. 2.)

Dr. Barton made the first drawing of this forceps more than twenty years ago. It was not until the first model was made in 1923 that attention was attracted to the possibilities of such an instrument. Experience with the Barton forceps has shown that the first model constructed had too wide an angle between the blades and the blades were too short, especially when applied to heads above the normal in

size. This led frequently to slipping of the forceps and may account for some of the failures reported in the appended case histories. Unfortunately, this is the model owned by a majority of men using this instrument. In the present model this defect has been corrected by lessening the angles between the blades and by increasing their length.

It takes considerable time and practice on the manikin to realize that it is not a traction instrument but rather one for leverage and rotation. The direction of the pelvic axis and the relation of the forceps to this axis must always be borne in mind. When the forceps are ap-

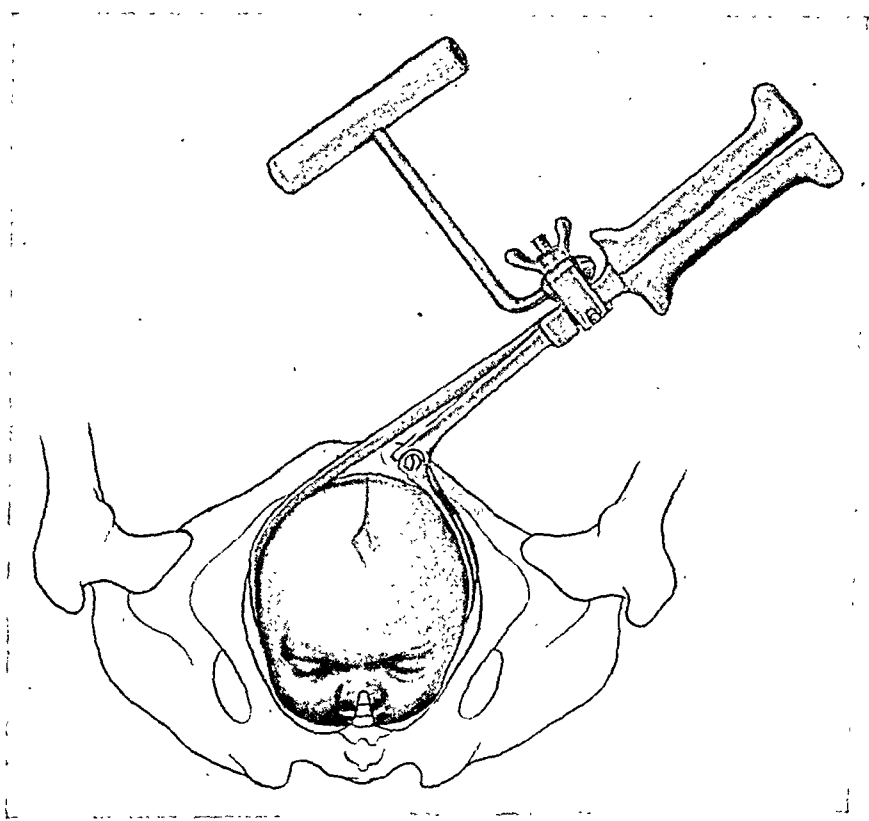


Fig. 7.—Delivery by extension of the head.

plied, at the brim or above, the sagittal suture must be directed backward toward the hollow of the sacrum before any attempt at traction is made. If the sagittal suture is directed downward or anteriorly, asynclitism results, with slipping of the blades and failure of the forceps. The anterior blade is of great use and is easily applied in helping to correct anterior or posterior parietal presentation. Its function in this instance is merely as a lever. Both blades can be used in helping in the rotation of a persistent occiput posterior in the hollow of the sacrum. We have found it more useful in these cases than any other forceps with which we are acquainted. Failure is common, and birth injuries result when attempts are made to rotate the head before the biparietal diameter has come through the pelvic brim.

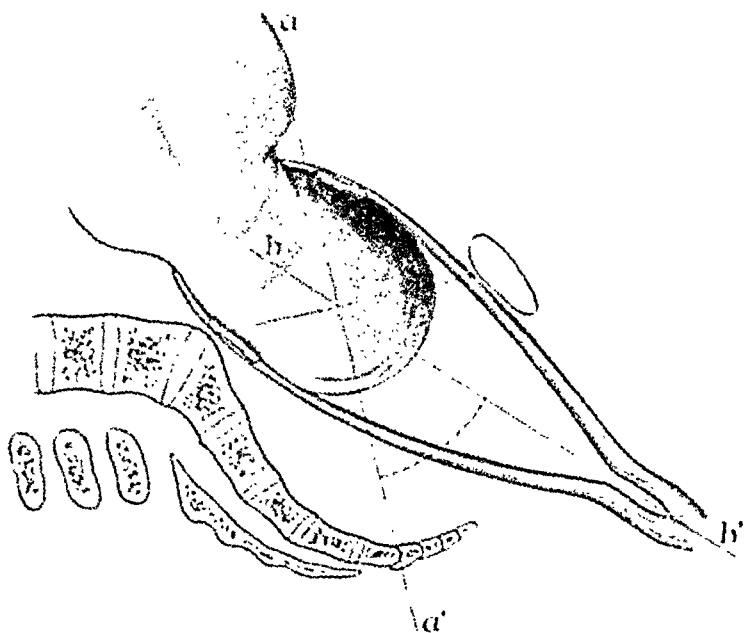


Fig. 8.—Cephalic application of the Tarnier forceps. Note lateral tilting of the head and faulty line of traction as represented by the angles formed by the lines  $aa'$  and  $bb'$ .

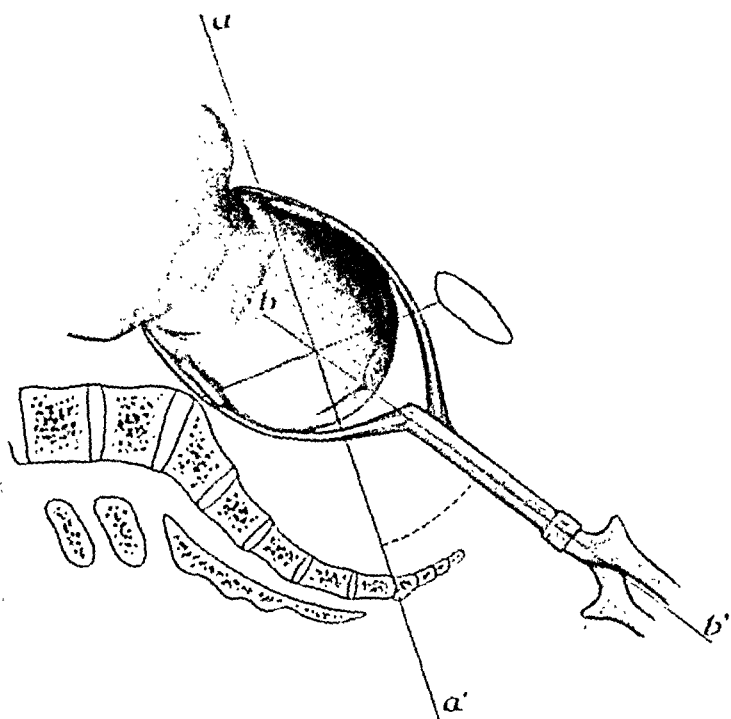


Fig. 9.—Cephalic application of the Kielland forceps. Note the lateral tilting of the head and faulty line of traction as represented by the angles formed by the lines  $aa'$  and  $bb'$ .

It is surprising how far down the head has to be pulled before this is accomplished and rotation can be attempted. With marked molding and a large caput succedaneum, it is often necessary to bring the head almost to the pelvic floor.

If the Barton forceps are to be used at the outlet after rotation, it is important to see that the shank of the forceps lies in a line perpendicular to the posterior fontanelle. Otherwise, slipping of the forceps with extension of the head and a consequent birth injury may occur. After rotating the head, the application of the ordinary type of forceps to complete the delivery is often the easiest maneuver.

During a period beginning November 23, 1924, and ending May 31, 1927, the Barton forceps have been used in forty-eight cases at Sloane Hospital for Women by thirteen operators. Of these cases fourteen have been classified as high, and thirty-four as medium forceps operations.

The cases in the first group showed an average labor of thirty hours before forceps were applied. Dry labor occurred six times. The pelvis was normal in six instances, simple flat in three, generally contracted in three, and in two cases there was a long symphysis with a poor inclination. Complete delivery was accomplished by Barton forceps in three instances. In the other cases some other type of forceps was applied after the head had been brought down to the floor and rotated by means of Barton forceps. No extensive laceration occurred. In four instances bad fetal results render the brief summarization of these cases worth while.

CASE 1.—7264. Para 0; gravida 1. Generally contracted pelvis with diagonal conjugate of 11.5 cm. Dry labor with duration of forty-four hours. Pains poor in quality. Bag used to dilate cervix. Barton forceps applied but failed to advance head. Forceful delivery by Simpson forceps and axistraction. Stillbirth.

Autopsy showed a lacerated tentorium and congenital pneumonia. Note on chart recommends cesarean section at next delivery because of bony disproportion.

CASE 2.—No. 6830. Para 0; gravida 1. Flat pelvis with diagonal conjugate of 11 cm. Duration of labor fifty hours with poor inefficient contractions. Head L. O. T. at brim. Barton forceps applied. Delivery accomplished with difficulty. Stillbirth. Autopsy showed laceration of tentorium.

This patient delivered normally in March, 1927.

CASE 3.—No. 6111. Para 3; gravida 4. Normal pelvis. Details of labor not noted. Head in R. O. T. at brim. Difficult delivery. Large baby; shoulders impacted. Died during reduction of latter. No autopsy.

CASE 4.—No. 8124. Para 0; gravida 1. Pelvis with long symphysis and poor inclination. Dry labor with a duration of twenty hours. Head R. O. T. at brim. Barton forceps applied but failed to advance head. Version and breech delivery. Stillbirth. No autopsy.

Only in Case 2 (No. 6830) can the bad result be attributed to the use of Barton forceps alone. Other factors are concerned in the remaining three.

The average duration of labor in the cases delivered by medium

forceps operation was twenty-three hours. Dry labor occurred fourteen times. The pelvis was normal in fifteen instances; in eleven cases a long symphysis with poor inclination was noted; of the remainder, five were generally contracted, three were simple flat, and one was a rachitic flat type. In sixteen cases the head was in the occiput posterior, in eighteen cases in the occiput transverse position when the forceps were applied. In eleven cases the complete delivery was accomplished with these forceps. In the remaining cases some other type of forceps was applied after the head had been brought down to the floor and rotated. No extensive lacerations were caused. Five cases are summarized below because of bad results, some of which are not due solely to the use of these forceps.

CASE 1.—No. 6573. Para 0; gravida 1. Flat pelvis with diagonal conjugate of 11 cm. In labor forty-nine hours with infrequent, inefficient pains. Barton forceps applied in midpelvis with head in L. O. T. Head brought down and rotated. Delivery completed with Simpson forceps. Baby in poor condition. Died second day. (Death may have been due to congenital pneumonia.) No autopsy. This patient had subsequent normal delivery.

CASE 2.—No. 7694. Para 0; gravida 1. Pelvis had long symphysis with poor inclination. Dry labor with irregular inefficient contractions. Duration twenty-seven hours. Barton forceps applied to head in R. O. P. in midpelvis. Unable to advance head. Delivery finally accomplished with Milne-Murray forceps.

CASE 3.—No. 9311. Para 0; gravida 1. Pelvis generally contracted with diagonal conjugate of 11 cm. Duration of labor thirty-seven hours. Fetal heart slowed so Barton forceps were applied to head in R. O. T. Complete delivery accomplished. Stillbirth. Autopsy showed bilateral tear of the tentorium.

CASE 4.—No. 9381. Para 0; gravida 1. Normal pelvis. Duration of labor not noted. Barton forceps applied to head in high midpelvis. No advance of head. Forceps were removed. Fetal heart had been good but now could not be obtained. Forceps reapplied and rapid forceful delivery was made. Stillbirth. No autopsy.

CASE 5.—No. 9702. Para 0; gravida 1. Normal pelvis. Duration of labor seventeen hours, a large portion of which was dry; weak contractions. Barton forceps applied to head in R. O. T. in midpelvis. Head brought to floor and rotated. Delivery completed with Milne-Murray forceps. Baby died on seventh day. Autopsy showed laceration of the tentorium.

In addition to the above cases Dr. Caldwell has delivered eighteen cases at other institutions by means of the Barton forceps, of which details are not available. Stillbirths occurred in four instances. In two cases the fetuses were macerated, in the remaining two the presence of the fetal heart was doubtful before the forceps were applied.

Dr. Barton and his associates have used the forceps in twenty-five cases in practice at Plattsburg, New York, and vicinity. All of these have terminated successfully for mother and child except in one instance, in which an eclamptic was delivered of a premature stillbirth.

There has been no maternal mortality and but one serious laceration in the entire series of cases.



## CONCLUSIONS

1. The Barton forceps allow an easy cephalic application in the axis of the birth canal, especially when the head is high in the pelvis.
2. The Barton forceps can be easily used to help correct malpositions of the presenting part.
3. The axis of the pelvis in its relation to the position of the child's head must at all times be considered.
4. The extraction of the child is by a leverage or modified Pajot's maneuver rather than by direct traction.
5. Cases in which these forceps are useful require careful study by a skilled obstetrician. They have a definite value in his hands.
6. They will not overcome bony obstruction. They will not overcome obstruction due to soft parts without injury to both mother and baby.

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## THE PRESENT STATUS OF THERAPY OF CANCER OF THE UTERUS\*

BY JOHN OSBORN POLAK, M.D., F.A.C.S., BROOKLYN, N. Y.

WHEN your President drafted me to speak at this, the opening meeting of his administration, I was at a loss as to the selection of a topic, for as we review the literature we cannot help but be impressed with the fact that the diagnosis and treatment of most of the conditions peculiar to women are accepted and standardized. This is apparently not so in the therapy of cancer of the uterus, for from the clinical reports which are constantly appearing, the superiority of the radical operation versus radium and x-ray still appears to be a subject of contention. For instance, Bonney, in a recent publication in which he reports 214 radical operations done at the Middlesex and Chelsea Hospitals for Women, proclaims the superiority of surgery; and Weibel with his immense mass of material and his high incidence of operability, claims results which have never been equaled in this country; i.e., 87 per cent cures in incipient cases,—53 per cent in the mild and 28 per cent in the severe type. On the other hand, Heyman, Foerschil, Döderlein and others champion the value of radium and perhaps justly so, for the primary operative mortality of the radical operation ranges from 5 to 42 per cent. It is therefore in an effort to give a summary of the present status of cancer therapy that I shall take up the discussion.

It may be said that definite progress has been made in the cancer situation, first, in the classification of the degree of malignancy, for

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\*Read at a meeting of the Brooklyn Gynecological Society, March 4, 1927.

serial sections of the specimens removed have shown that certain groupings and forms of cells are more malignant than others and all pathologists are agreed that the spindle-celled cancer is the least malignant. Though these facts have been definitely settled, it has not been determined whether this form of cell is more amenable to surgery than to radium. All of this study has, however, demonstrated the necessity of cooperation between the pathologist and the clinician, and proves that our cancer slogan must be *early diagnosis* and *intensive treatment*.

A second step in progress has been a better appreciation of the routes of extension, for this has made it possible to limit the lymphatic advance in cervical cancer by the production of lymphatic block. Lymphatic block may be accomplished either by surgery or by the x-ray. Furthermore, the accepted recognition of the fact that *only one group of cases*, that is, those which are classed as Group I, *where the growth is wholly within the confines of the cervix*, are amenable to surgical extirpation, is a great step in advance, for the acceptance of this principle will save many lives and prolong the life of many others. *This means that all borderline cases fall within the range of radium and not operation.* Nothing spreads cancer so quickly as the manipulation of cancerous tissue, such as occurs when an incomplete extirpation is made through malignant structures.

In a collective review on this subject, which I published a year or so ago, I called attention to the high operative mortality of radical extirpation of the uterus for cancer of the cervix, and then stated that all experimental study has shown that the cancer patient produces an immunity of varying degree to the extension of any malignant growth. This is evidenced by the surrounding cellular infiltration, the glandular enlargement, and the glucose consumption. Anything which breaks down this resistance, such as blood loss, tissue trauma or metastatic extension through manipulation, or change in the sugar content of the blood as produced by anesthesia, favors extension.

In support of these clinical observations, the result of postoperative studies has shown that at every operation in which the abdomen is opened, which entails the use of general surgical anesthesia, there is reduction in the blood sugar and in the carbon-dioxide combining-power, together with blood loss and tissue trauma. These are constant factors which are met with and must be combated.

These clinical findings are supported by the experiments conducted by the late Doctor Harvey Gaylord, who, while in charge of the New York Institute for the Study of Cancer, made a series of experiments on rats with implanted malignant growths. Gaylord found that he could implant cancer in a healthy rat, feed the rat properly and give it limited freedom; in other words, if he could keep up the rat's natural resistance, the rat established an immunity against the growth which would

remain stationary for periods of three to five years. When, however, he began giving these rats general anesthetics, he was surprised to find that there was an immediate extension of the growth which had lain so long dormant. This we know was probably due to the effect of the anesthetic on the sugar content of the blood and to the lowered carbon-dioxide-combining-power, both of which reduced the individual resistance.

The second experiment consisted in bruising the tissues which immediately surrounded the graft; this again led to rapid extension.

Having demonstrated that an implanted growth would remain dormant unless the contiguous tissue was traumatized and the immediate protective barrier broken down by the lack of sugar content, he began to study the effect of anemia on the development of implanted growths. He, therefore, began by drawing off one or two drops of blood each day from the rat's tail. When he had produced a moderate secondary anemia, he found that the cancer implant grew very rapidly.

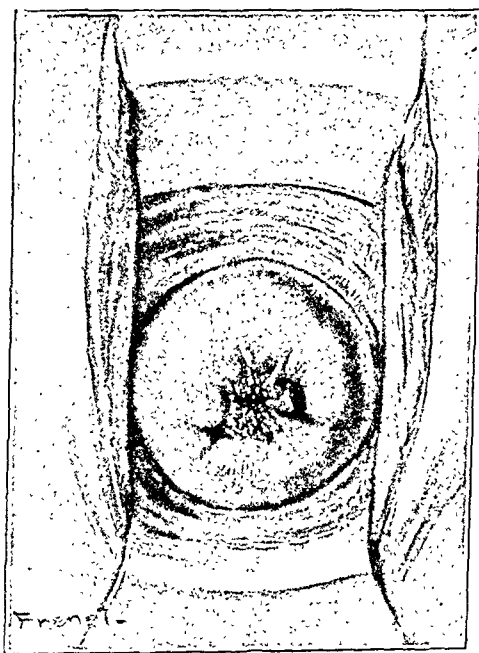


Fig. 1.—Cervical epithelioma, inverting type.

In view of these experiments it seems apparent and in line with the clinical experience of every operator, i.e., that these basic conditions obtain at every operation and that, unless the entire growth is removed and the surrounding glands extirpated, operation hastens rather than defers the final termination by supplying the three factors that have been referred to in these experiments.

Cancer of the cervix may begin as a nodule on the portio, in the cervical canal, or in the cervical glands. When it has its origin on the portio or in the columnar epithelium of the cervical canal, it appears as an epitheliomatous growth; while when its origin is in the cells lining the glands of the cervix, it takes on the form of an adenocarcinoma. Clinically, the growth may assume an inverting or everting character. It is in the latter that the earliest subjective symptoms

appear. Whatever its origin and whatever its cause, the earliest subjective symptom of cervical cancer is some form of anomalous bleeding. This bleeding does not appear until tissue necrosis has occurred, hence while hemorrhage is the earliest symptom, the growth in the inverting type may have advanced to a considerable extent before this sign is manifest. This explains why so many cases pass unrecognized in their incipency; for it is not until we treat every suspicious ulceration and bleeding as a potential cancer and have the cooperation of a competent laboratory, that we may hope to make great advance in the early diagnosis. Even in Austria, where cancer propa-



Fig. 2.—Section through cervix showing extension in inverting type with an innocent looking external os.

ganda has been carried into every home, only 6.5 per cent come to the surgeon in the incipient stage.

Cervical erosion is a constant precursor of cancer, while extreme cervical laceration with ectropion supplies another source of chronic irritation. Therefore, we can appreciate what a heavy responsibility is placed upon the practitioner in the treatment of cervical lesions resulting from laceration or infection. The preventive treatment of cervix cancer will hinge upon the differential diagnosis of these conditions and their proper treatment.

Some years ago, Hofmeir called attention to the fact that a simple ulceration or an erosion was coated with a mucoid discharge, while malignancy always changes the character of the discharge; and that if a 10 per cent solution of copper sulphate was applied to the sur-

face of a simple erosion or ectropion a resulting white eschar would form upon it, while if it were a cancerous ulcer the copper sulphate solution would cause it to bleed. For many years this suggestion and the friability of cancerous tissue have aided us in making the early diagnosis. However, we do not depend on this or on any other physical appearance, but subject the cervix in every suspicious case to histologic study.

Just a word as to taking biopsy specimens. The section should be removed with a very sharp, thin-bladed knife *and the wound immediately sealed with the actual cautery*, for all experience shows that curetting or removal of a specimen with a tonsil punch is apt to cause

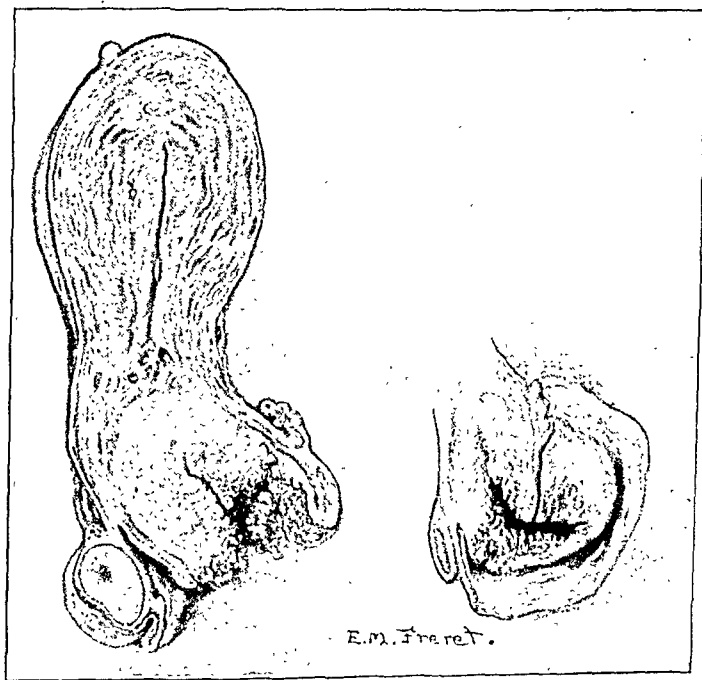


Fig. 3.—Everting type. Extension along contiguous vaginal mucosa.

metastatic extension just as vigorous or repeated bimanual manipulation will do the same thing. Cancerous tissue *must be* handled gently.

*Remember that every failure to make a diagnosis of incipient cancer costs a human life;* therefore, it is better and less harmful to take ten unnecessary biopsy specimens than to miss one in which the disease has actually developed.

The preventive treatment of cancer is what should occupy us at the present time. This means the cure of endocervicitis, cervical erosions, and the repair of lacerations, or the amputation of extensively diseased cervixes which are found in women during the third decade of life.

When cervical cancer is recognized, the question that must be settled at once, before the selection of any form of radical treatment is

instituted is, within what group does the cancer fall? Group I implies an ulcer or nodule on or in the cervix surrounded by an immediate area of infiltration. The tissue bleeds on manipulation or on the application of a tenaculum. There must be no extension into the parametria or into the adjacent vaginal wall. Rectoabdominal examination of both broad ligaments and of the uterosacrals will demonstrate this point. Bimanual examination of the fornices will exclude any extension along the mucous membrane or into the uterovesical tissues. *Only this class, where the growth lies wholly within the con-*

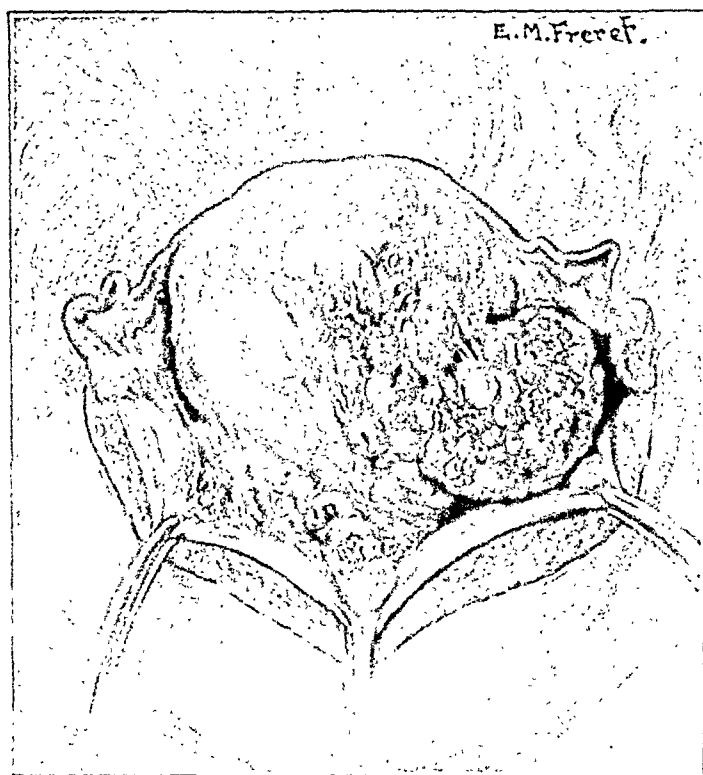


Fig. 4.—Extension of a corporal cancer through the uterine wall.

*finis of the cervix, having free mobility, should be considered for radical surgical extirpation.*

The so-called Wertheim operation or radical extirpation which includes removal of tubes, ovaries, parametria, vaginal cuff and contiguous iliac and sacral glands, carries with it an operative mortality of from 5 to 42 per cent.

Bonney's report of 214 consecutive cases showed 34 deaths directly attributable to the operation. Weibel, whose vast experience has permitted a perfection of technic, has a 3 to 10 per cent primary mortality, and the end-results after five years run from 87 per cent (Weibel) to 33 per cent (Clarke) in incipient cases. About 50 per cent of the primary fatalities are from septic peritonitis.

When we compare these figures with those obtained from radium

after the five- and seven-year period with no operative mortality, such as the results reported by Haymen and Forsell who with a 100 per cent follow-up have 59 per cent of cures, or those of Ward with 52 per cent and those of Bailey and Healy with 51 per cent, we cannot but be impressed with the fact that the destruction of the cancer cell is as complete even in its early stages by radium as by any form of surgical extirpation. Radium has had its greatest triumph in the treatment of cancer of the cervix uteri.

The contention as to the relative value of operation or radium in Group I cases in some clinics is not definitely settled. In this country the radical operation is a matter of history. There is no difference in opinion as to the value of radium as a palliative measure in the treatment of all borderline and advanced cases, for with radium we can control the hemorrhage, heal the ulcer, and thus diminish the septic absorption and retard the extension. If we add to irradiation lymphatic block by the x-ray, or lymphatic block and circulatory starvation by abdominal incision, excision of the lymphatic chain and ligation of the internal iliac arteries, we can prolong the life of the cancer patient for a very considerable time and often cure the supposed incurable case.

Regarding malignancy of the body, it is an accepted fact that early total hysterectomy with bilateral salpingo-oophorectomy and wide excision of the round and infundibulopelvic ligaments, gives from 65 to 80 per cent of cures. This is accounted for by the fact that we have an early danger signal in body cancer; namely, a bloody uterine discharge which is always anomalous in a woman at or past the menopause. Every anomalous bleeding at this time should be regarded with suspicion and should be subjected to diagnostic curettage and examination of the biopsy specimen. Adoption of this plan will give a positive diagnosis of malignancy in nearly 50 per cent.

Now a few words of warning as to the dangers from diagnostic curettage. First, lymphatic avenues are opened and metastasis may occur. It is, therefore, well to precede the curettage with a hypodermic of pituitary extract, using one or two ampules to maintain the contraction of the uterus during the removal of the tissue for examination. Second, radium should be immediately introduced into the body in order that the lymphatics may be sealed. This furthermore presupposes that with the dilatation, curettage, and the introduction of radium, the vaginal flora have been transferred upward into the uterine cavity and explains the frequent temperature reactions which follow this simple diagnostic procedure. Experience has taught us that it takes from four to six weeks for the uterus to sensitize itself to this bacterial invasion and that if hysterectomy is done, say, a week after the introduction of radium, the operation will be followed by

death or by morbidity, while, if on the other hand, we wait for the uterus to sensitize itself, as Curtis has shown, and do not operate until from four to six weeks after the diagnostic curettage has been done and the radium inserted, the results will be satisfactory.

To summarize: We would say that in this country and Europe, radium has replaced the radical operation in the treatment of all cases of cervical cancer except possibly in incipient growths upon the portial surface. Even in these the high primary operative mortality more than balances the possible advantage of operation. In cancer of the body preoperative radiation followed by total hysterectomy with postoperative radiation is the accepted procedure. Our personal experience favors preoperative radiation a month or six weeks prior to extirpation.

20 LIVINGSTON STREET.

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Neverman, H.: Foreign Protein Therapy in Inflammatory Tumors of the Adnexa. *Archiv für Gynäkologie*, 1924, cxxii, 273.

Neverman used arthigon, turpentine, aolan, caseosan, and yatren injections in 208 cases of inflammatory tumors of the adnexa and checked them carefully by follow-up examinations averaging twenty-one months following the course of treatment. There were 411 cases in the Hamburg clinic during this same period which were not subjected to foreign protein therapy but were given only supportive treatment, symptomatic treatment, and absolute rest. There was practically no difference in the subjective or objective results in the two groups, and the author concludes that foreign protein therapy has no therapeutic value except for the psychic effect upon the patient. Those who receive this form of treatment feel better because they feel that something active is being done in their behalf, and this is of great value in private practice. He therefore believes that foreign protein therapy has a definite place in the treatment of inflammatory tumors of the adnexa.

RALPH A. REIS.



## ABDOMINAL REPOSITION IN ACUTE INVERSION OF THE PUERPERAL UTERUS

BY JAMES LINCOLN HUNTINGTON, M.D., FREDERICK C. IRVING, M.D., AND  
FOSTER S. KELLOGG, M.D., BOSTON, MASS.

THIS paper deals with five cases of inversion of the uterus immediately after delivery. All were treated by abdominal operation with recovery in each instance. One of these patients has since been delivered normally twice without recurrence of the inversion. In another the condition was complicated by instrumental perforation of the uterus. Two cases were operated on two hours after delivery; one, four hours; one, ten hours; and one, thirty-six hours. All were transfused at the time of operation.

In three of these cases an attempt was first made at vaginal reposition, without success. In each instance hemorrhage was so profuse that the operator desisted and packed the vagina. In one of these cases, which had been delivered thirty-six hours, the cervix was found to be tightly contracted about the lower uterine segment. In the remaining two cases no attempt was made at manual restoration but laparotomy was resorted to forthwith.

After a completely inverted uterus has passed through the cervix that structure contracts around the lower uterine segment. Since the inverted fundus is much too large to be forced through the cervix the only way in which reposition can be effected manually is by inserting the tips of the fingers into the sulcus between the cervix and the lower uterine segment and making upward pressure. In this way that portion of the uterus which inverted last will undergo replacement first. It is this principle but carried out from above, that has been used in the abdominal operation performed upon these five patients. While we are aware that, favored by ample dilatation of the cervix, the recently inverted uterus has been replaced a number of times successfully, we nevertheless think that the abdominal method here described is attended with less risk and more certainty.

In the five cases reported in this paper we employed the operation devised by Huntington and described by him in the *Boston Medical and Surgical Journal* (April 14, 1921). The abdomen is opened by a low median incision. If there is complete inversion, the uterus is absent from the pelvis, there being a crater in the region of the cervix into which have been drawn the tubes, round ligaments and occasionally one or both ovaries. The operator and his assistant are both armed with two Allis forceps. Each inserts one of his forceps into the crater for

about an inch and grasps the surface of the uterus on his side. Both draw upward simultaneously, pulling a portion of the uterus out of the ring and restoring it to the peritoneal cavity. (Fig. 1.) Steadying the uterus by the forceps already applied the operators now insert their second forceps into the crater for about the same distance as before, again grasp the sides of the uterus and pull upward. Thus by successive bites and upward tractions (Fig. 2) the uterus is gradually restored to its normal position in the abdominal cavity. (Fig. 3.)

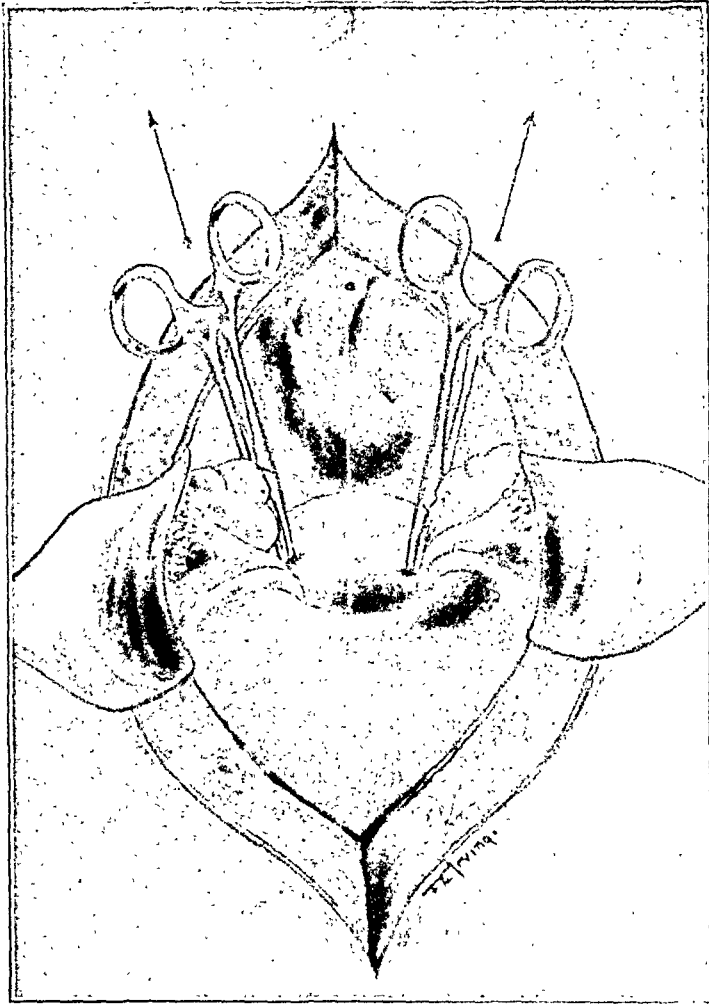


Fig. 1.

Since this paper is intended solely to demonstrate a method of treatment, we have attempted no collective review of inversion of the uterus as reported in the literature, nor have we thought it advisable to speculate upon the etiology of the condition.

CASE 1.—(Huntington) This patient, a 33-year-old para iii. had gone through a normal pregnancy, labor and puerperium with both preceding children. The present labor was terminated by easy low forceps at 6:20 A.M., Nov. 11, 1919.

Fifteen minutes later gentle pressure on the fundus revealed the placenta at the introitus and it was easily delivered. Moderate bleeding ensued and ergot and

pituitrin were given intramuscularly. The pulse was 80 but of only fair quality. What appeared to the assistant to be a rather nodulated fundus as felt through the abdominal wall seemed hard and well contracted. The bleeding continued and the pulse became a little poorer in quality although it still remained at 80. The patient's face grew pale and drawn and arrangements were made for a transfusion. Every five or ten minutes about half an ounce of dark blood would escape from the vagina. At the end of an hour transfusion was definitely decided upon and preparations were made to pack the uterus. Upon introducing the hand the

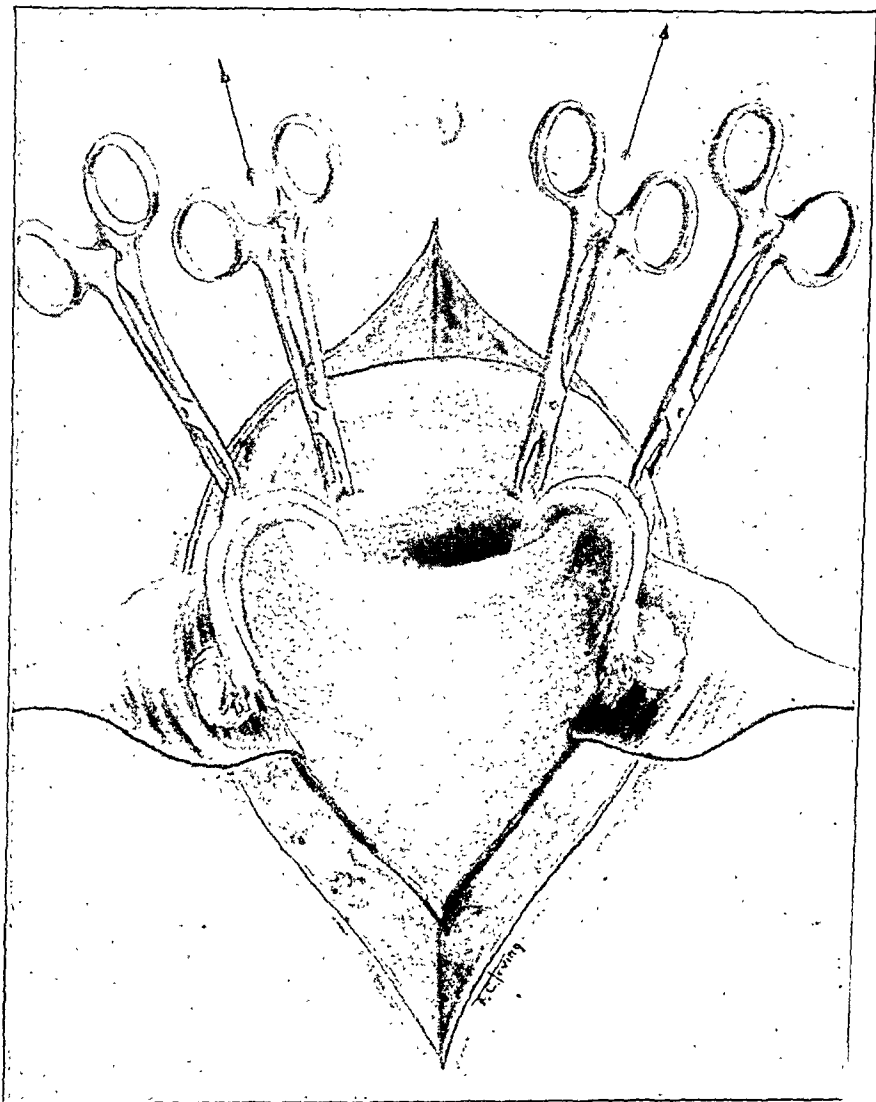


Fig. 2.

inverted fundus of the uterus was found projecting through the cervix, which was hugging it like a collar. When an attempt was made to effect reposition by pressure from below blood poured from the vagina. Immediate laparotomy was then done. The patient was almost pulseless. As the abdomen was opened a transfusion was started. Both appendages had been drawn into the crater. Reposition was effected by the method described above and the abdomen closed in layers.

By the time the transfusion was half over the patient's pulse was strong at the wrist and decreasing rapidly in rate. When the patient left the table her pulse was 90 and the systolic blood pressure 100.

The recovery was uninterrupted. Six weeks later pelvic examination revealed the uterus in anterior position, freely moveable, of normal size; the cervix long and conical. The os was practically intact and much smaller than is usually found in a multipara. There have been no further pregnancies.

CASE 2.—(Irving) At 6:30 A.M., November 29, 1920, this patient was delivered after a seven hour primiparous labor by low forceps with the scalp in sight. The placenta, which was thought to have separated, was expressed by Credé's maneuver.

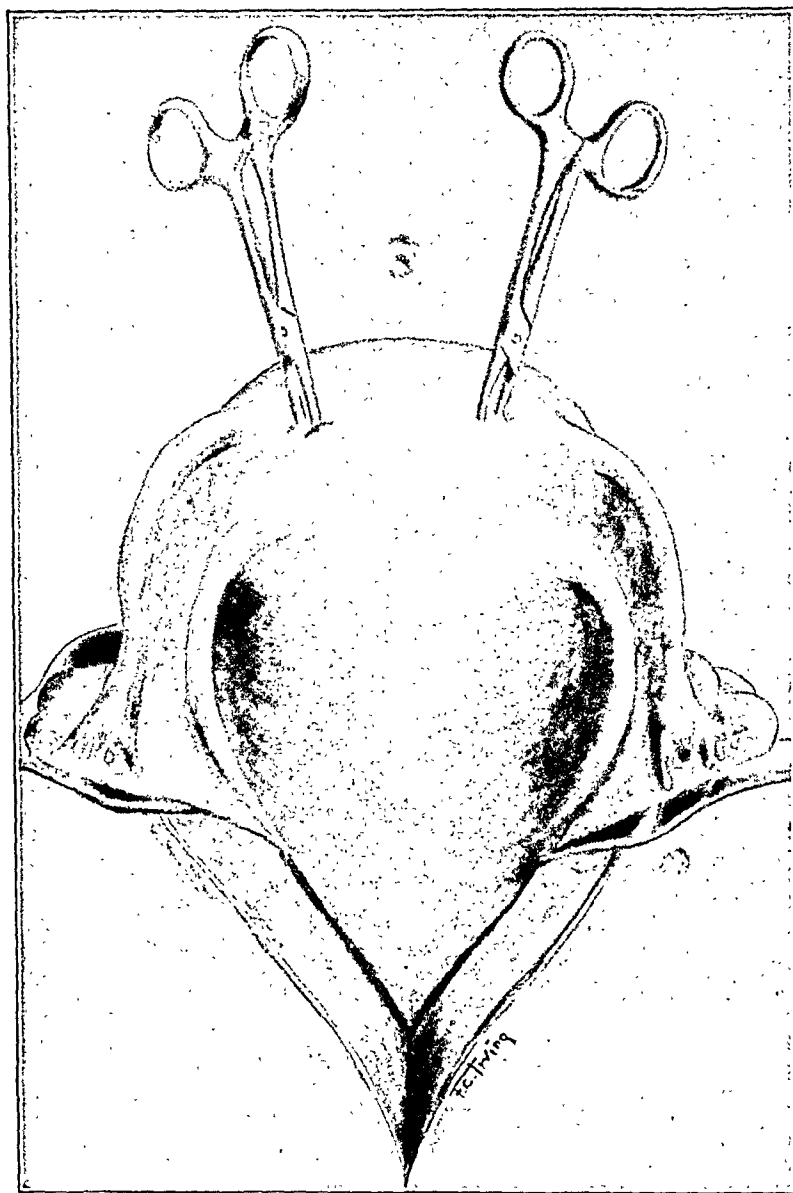


Fig. 3.

About one-half of the membranes were torn off and left in utero. The patient was then in good condition, her pulse being 112. Two hours later the pulse had risen to 132 and was of poor quality. There was more than the usual amount of bleeding. Thinking that the retained membranes were the cause of the hemorrhage the patient was etherized and the vagina was found to be occupied by a mass the size of a grapefruit. There was a small dimple on the left of the most dependent portion of this mass. Mistaking this for the cervix her attendant introduced a long Reynolds curette into it for the purpose of removing the membranes.

This instrument immediately disappeared up to the handle and was withdrawn. About this time an obstetrician was called in consultation. He examined the patient and stated that there might be an inversion of the uterus or that the uterus might possibly have been torn loose from its attachments.

The patient was first seen in consultation by one of us (F. C. I.) at 1:30 P.M. At this time a midline tumor reaching to within an inch of the umbilicus was found. There was no active bleeding but the patient was very pale; the pulse, perceptible at the wrist, was 140. When a five yard packing strip was removed from the vagina the mass which had been palpable in the lower abdomen disappeared and a completely inverted uterus was evident. The cervix was found to be fully dilated and in apposition with the walls of the bony pelvis. A small hole admitting a finger was discovered to the left of the fundus and somewhat posterior; undoubtedly where the curette went in. No attempt at replacement was made and the vagina was repacked.

At 4:00 P.M. the abdomen was opened, the patient being transfused at the same time with 700 c.c. of Group IV blood. The inversion funnel, in diameter about two inches, was found presenting. The uterus was replaced by the same method employed in Case 1. The perforation caused by the curette was closed with No. 2 chromic catgut interrupted and No. 1 chromic catgut continuous sutures. A cigarette wick was placed to the left of the uterus and the abdominal wound closed to the drain in layers. One ampule of pituitrin was given intramuscularly. The patient was in good condition on leaving the table. Her pulse was easily palpable at the wrist and of satisfactory quality. The vaginal pack was removed. There was no further bleeding.

The patient had an elevated temperature for several days and discharged some pus from the abdominal wound. Her convalescence was not unduly protracted and she was discharged from the hospital in good condition.

On July 7, 1924, the patient presented herself for examination. She had had no further pregnancies. There was at this time a slight bloody vaginal discharge, a small bilateral tear of the cervix. The uterus was of normal size and in anterior position. Nothing abnormal was made out.

CASE 3.—(Huntington) The first pregnancy of a 22-year-old para ii had been terminated by a breech delivery. The present pregnancy ended in the spontaneous delivery at 4:30 P.M., April 23, 1922, of a nine-pound, thirteen-ounce child which had presented by the vertex. There was no unusual amount of bleeding during the third stage of labor but as the placenta did not come away for thirty minutes it was expressed by Credé's maneuver, only a moderate amount of pressure being necessary. Since the bleeding which followed was somewhat excessive ergot and pituitrin were given intramuscularly. Five minutes later, as the loss of blood still continued the vagina was explored and the uterus found to be inverted. An attempt at replacement only resulted in an increase in the hemorrhage so it was abandoned and a vaginal pack introduced. The same abdominal operation was performed upon this patient and she was transfused simultaneously. Although she was almost pulseless when the abdomen was opened she rallied promptly and made an uninterrupted convalescence.

Since then this patient has had two normal deliveries without incident. On each occasion the placenta was removed manually from the vagina without resort to any pressure on the fundus.

CASE 4.—(Kellogg) This patient, a primipara, when seen in consultation by one of us (F. S. K.) at 4:00 P.M., July 29, 1924, had been delivered by easy low forceps early the morning before. There had been no traction on the cord and the birth of the placenta had been effected without effort by Credé's maneuver. The attendant had given what he considered to be an intrauterine douche for the hemorrhage which followed. A state of shock with a weak, rapid pulse supervened,

but the patient improved under treatment. Two hemorrhages occurred in the next thirty hours. The physician then found on examination a mass filling the vagina which he took to be an inverted uterus, a large myomatous polyp, or a combination of the two.

When seen in consultation the patient was pale, her pulse 120 and her temperature 99°. On abdominal palpation a tumor rising one inch above the symphysis was found in the midline but no central depression could be made out. On vaginal examination the uterus was found to be inverted and firmly gripped above by the tightly contracted cervix, which was dilated only about one and three-quarter inches.

At 7:00 P.M. an attempt was made to reduce the inversion *per vaginam*. Owing to the tightly contracted cervix this was found to be impossible and resulted in such profuse hemorrhage that it was immediately abandoned.

On opening the abdomen both tubes and ovaries were found drawn into the crater. Traction by Allis forceps easily restored the uterus to its position in the abdominal cavity.

The patient was transfused coincidently with the operation but was in a precarious condition for the first twenty-four hours following. Her convalescence was complicated by a moderate uterine sepsis and an attack of femoral phlebitis but she ultimately recovered.

CASE 5.—(Kellogg) The last patient was a 24-year-old para ii. Her family physician delivered her of her first infant by high forceps after a six and one-half hour labor on August 8, 1924. She made a normal convalescence.

Her present pregnancy was uneventful. She was delivered normally by an externe under supervision in the Boston Lying-in Hospital at 8:32 A.M., August 17, 1926, after four hours of labor. The placenta was expressed fifteen minutes later by Credé's maneuver with some difficulty. There was partial retention of the membranes. The pulse was 120, the color good. The uterus did not contract well and the fundus was found to present a dimple on palpation. The house officer was unable to introduce his hand into the uterus to discover if it was partially inverted as the cervix was tightly contracted. The patient then went into collapse with irregular respirations and a rapid pulse. She was pallid, the skin was cold, the lips slightly cyanotic and the eyes exhibited nystagmus. The patient became unconscious and the blood pressure fell to 50 systolic. More than the usual amount of blood postpartum escaped from the vagina. Under supportive treatment and while awaiting the arrival of a suitable donor for transfusion the pulse improved and the systolic blood pressure rose to 80.

At 12:20 P.M. the abdomen was opened and at the same time the patient was transfused with 500 c.c. of citrated blood. The uterus was found to be partially inverted, the fundus and both cornua being in the funnel with the distal ends of both tubes and the ovaries just outside the margin of the ring. Reposition was effected in the usual manner and was accompanied by a sudden and marked improvement in the patient's condition. The lips became pink, the pulse improved and the respirations became rhythmic. The wound was then closed in layers.

The patient made an uninterrupted recovery. On discharge the cervix was found intact and posterior, the uterus anterior and well involuted. The vaults were free and there was no uterine discharge.

#### SUMMARY

1. Five cases of acute puerperal inversion of the uterus are reported; four complete and one partial.

2. In three instances manual reposition was attempted without success and was abandoned and the vagina packed on account of hemorrhage.

3. Manual reposition in some cases is impossible and may be accompanied by such free bleeding that it is questionable if it should be attempted.

4. All five cases were easily and successfully treated by abdominal reposition of the uterus by the method here described.

5. All five cases were in such poor condition that they were transfused at the time of operation.

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## ENDOCRINE THERAPY\*

BY ROBERT T. FRANK, A.M., M.D., F.A.C.S., NEW YORK CITY

ENDOCRINE therapy was based on a mistake. This most romantic chapter of modern medicine, which, paradoxically, links the science of today more and more closely with the humoral pathology of the ancients, began with the spectacular and fallacious report presented by Brown Séquard before the Société de Biologie of Paris, in 1888, dealing with the rejuvenating effect of testicular extract. Upon this insecure foundation, a tremendous superstructure has sprouted with mushroom speed. Again and again, because of the haste of its architects, the lack of solid foundation stones, and the weakness of its structural material, this airy scaffolding has threatened to topple and fall, but today, an ever increasing host of earnest and indefatigable workers are swarming busily, shoring, underpinning, aligning, reconstructing, and fortifying with solid facts, the sketchy skeleton which more and more is assuming the solid, safe, and balanced proportions of a completed edifice.

The first sound observations made in endocrinology were clinical. I instance Parry, who described exophthalmic goiter in 1825; Addison, who in 1855 gave a complete description of the pathology and symptomatology of tuberculosis of the adrenals, and Kocher and Reverdin, who in 1882 outlined the effects following removal of the thyroid gland (athyreosis).

As early as 1849 Berthold transplanted the testes of cocks and thus demonstrated the internal secretion of the testes. His important contribution aroused no interest. The first successful use of endocrine therapy was made in 1892 by Murray who gave fresh or glycerin extract of thyroid glands to a woman suffering from myxedema, and kept this patient in excellent health for a period of thirty-four years. This striking and wonderful result produced a frenzy of enthusiasm when it was fully appreciated. In consequence of this apparently simple method of gland therapy, it was hastily concluded by a large

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proportion of the profession that the problem of endocrine therapy had been solved. Every imaginable gland and body tissue was prescribed with most unanimous failure. It has taken years of study, of trial, and of exhortation, to bring the saner members of the profession to recognize that the problem is not simple. Only in the last few years has marked and encouraging progress been made.

In contradistinction to the ill-balanced haste with which endocrine therapy was taken up and exploited, the clinical study of endocrine diseases has progressed steadily and has now reached a considerable degree of perfection. The functions of the glands of internal secretion, with the exception of the thymus and pineal, as well as a large number of syndromes due to disturbance of their action, can be outlined with a considerable degree of assurance. The effect of the various glands upon metabolism and growth has been thoroughly studied, as well as their influence upon the nervous system, especially its autonomic division. Attempts to analyze the interrelation and interaction of the glands upon each other and the consequent development of polyglandular syndromes have not been as successful and still are in a hazy state.

Lately into the chaos of endocrine therapy, which has been a whirlpool of empiricism, charlatanism, and even gross fakery, a bright beam of light has penetrated. The voice of laboratory investigators who have been far removed from the clamor of the market place, the steadying suggestions of the pharmacologists, the revulsion of the disappointed enthusiasts, and the few voices raised from the onset in the cause of common sense and common decency, are beginning to be heard and hearkened to. In addition, the striking and incontrovertible effects of the few endocrine remedies which have been perfected tend to sober the clamorous crowd sufficiently to realize that potent endocrine substances in minute concentration produce sharply recognizable effects, and in overdose may cause severe symptoms of poisoning. Adrenalin, pituitrin, thyroxin, insulin, the parathyroid hormone, the female sex hormone, one and all, whether the partial hormone, i.e., druglike extracts like the two first mentioned, or the physiologically fully potent substitute, possess these qualities.

I therefore foresee in the immediate future, not only a return to sanity, but the demand for objective pharmacologic and physiologic criteria and proofs before the further employment of any endocrine remedies is resorted to.

After the introductory era of clinical investigation which first called to our attention the startling effects produced by the normal activity of the glands of internal secretion as well as the more dramatic and recognizable results consequent to disease of these glands, all substantial advances thereafter made have resulted from physiologic and



pharmacologic investigation. It is upon these that I desire to focus your attention.

Remember that the physiologist is in a predominantly favorable position to study the normal action of a given gland. He is able to practice complete or partial ablation as well as transplantation, and in certain instances can correlate the effect observed in experimental animals with the symptoms found in disease. With the help of the pharmacologist and chemist, he has attempted replacement and substitution therapy. This path has not been as easy as the first fortunate experience of Murray promised, because the thyroid gland appears to be the sole endocrine depot in which the active substance is found stored and ready for immediate use.

The pharmacologist and chemist first isolated a simple partial hormone, if I may coin this word, namely adrenalin. After its isolation, Aldrich and Takamine succeeded in synthesizing this substance (1901). Again our hopes were aroused to a high pitch, but today physiologists affirm that adrenalin exerts no influence on the bodily functions. Many barren years elapsed before Kendall isolated thyroxin and reported its formula, upon the accuracy of which, however, serious doubt recently has been cast by Harington who proposes an entirely different structure for this substitute for thyroid substance. Pituitrin, also a partial hormone, the product of the posterior lobe of the hypophysis, although readily extracted and apparently not very complex in its structure, has as yet resisted chemical isolation. Quite recently the powerful and toxic hormone, insulin, has been prepared by Banting, Best, and Collip, but it is not yet completely purified or isolated, and still more recently, Collip has presented us with a fairly active parathyroid hormone, as yet in somewhat crude form. Lastly, female sex hormone has been obtained in unstable but already usable concentration by several investigators, and an active anterior pituitary extract appears to be in its birth throes.

The real reason that such noticeable advance has been made in the last decade is solely due to the fact that the pharmacologist, physiologist, and chemist have finally supplanted the empiric investigator. *Each advance has been based upon the discovery or elaboration of some specific and pathognomonic test for a given endocrine product.* Without such specific test it is almost impossible to attempt either to find, purify, or isolate a hormone. Let me instance a few of these tests to convince you. Adrenalin in less than one-millionth dilution produces inhibition of the intestinal muscle, the uterine muscle of the pregnant cat responding with contraction; one milligram of thyroxin speeds up the basal metabolism 2 per cent; insulin reduces the blood sugar in definite proportion and in overdose causes hypoglycemia (one unit equals the amount required to induce convulsions in a 2 kilogram

rabbit); parathyroid hormone affects the calcium metabolism quantitatively and relieves the spasms of parathyreoprival tetany; the female sex hormone produces estrual phenomena in the castrate mouse or rat and initiates the sudden onset of puberty in the immature rodent. I do not hesitate to predict that as soon as a specific test is elaborated for the adrenal cortex as well as for the male sex hormone, active preparations will shortly be discovered.

We surely agree that all rational therapy must be based upon accurate diagnosis. Therefore, before either attempting to prescribe an endocrine product or to influence an endocrine gland by any therapeutic measure, the cause of the derangement, its gravity, and extent should be known. Otherwise treatment is purely experimental, empirical and with few exceptions, futile. To arrive at such a diagnosis, a thorough examination is essential.

The three most striking and frequent syndromes encountered have to do with the pituitary, the thyroid, and the ovaries, for in order to simplify my task and as is justified before two societies whose practice is limited to women, I shall confine myself to the discussion of female patients. Needless to say, if glycosuria, tetany, marked asthenia with pigmentation present themselves as leading symptoms, investigation of the pancreas, parathyroid, or adrenals cannot be omitted, but in the majority of cases, I repeat, the three glands that I have first enumerated will be the ones primarily requiring investigation.

The history plays an important rôle. From it the time of onset may be assigned to a given period of the life cycle: onset in childhood favoring an hereditary basis, in adolescence perhaps ascribable to remediable faults in hygiene, during maturity resulting from the stress of sex life or the undue demands necessitated by the struggle for subsistence, all of these differing from the involution of senescence. It is essential, too, to determine whether the disease is of functional origin, as so many of the nervous manifestations due to disturbance of the autonomic nervous system prove to be, some of them branching imperceptibly into the neuroses, others simulating or actually followed by hyperthyroid conditions; or organic, in which case definite evidence of organic changes can be elicited. Some symptoms are transitory, some progressive, some stationary. The progress to be expected is of importance from the viewpoint of prognosis as well as to evaluate the effect of therapy. Certain disturbances are self-limited, as the goiter of adolescence; some are stationary, as the eunuchoidism which manifests itself in high stature or infantilism which inhibits the development of the genital tract; some progressive, as the bone disturbances of acromegaly.

The physical examination should include not only the cardiovascu-

lar and renal systems as well as the routine employed by every careful practitioner, but also the recording of abnormalities of stature, preponderance of extremities over body length, gracility or thickness of bones, facies, posture, and quickness of response. The secondary sex characters are of importance; voice, amount of hair, hair distribution, texture of skin, the amount and distribution of the subcutaneous fat, and the psychic response should be investigated. Patients may be divided arbitrarily into two groups which may be designated as the plus or the minus. The plus class includes those who are quick, alert, with rapid pulse rate, fine tremor, increased reflexes, moist skin, and frequent flushes. The minus class are the reverse; their response is slow, their demeanor sluggish, their pulse slow and regular, the skin is dry, the hands steady, the reflexes are diminished.

Of importance are signs of exophthalmos including the usual lid symptoms. Prominence of the superciliary ridges, spacing of the teeth, and spade or taper fingers give a rough preliminary indication of the functional activity of the hypophysis. The size of the thyroid is deceptive, hyperactivity frequently accompanying a palpably small gland. Breast development, unless extremely atypical, is rarely of much value in diagnosis. Infantilism documents itself by gracility of the body, contracted bony pelvis, marked shortening of the vaginal fornices, as well as by hypoplasia of the cervix. The uterine fundus is such a variable quantity and responds so readily to ovarian activity that it cannot be taken as a guide unless hypoplasia is noted over a long period. The routine physical examination will rarely, except in advanced conditions, give more information than this. Additional information can be obtained only by means of more detailed and special examinations.

These should include at least the following special tests: basal metabolism, differential blood count (lymphocytosis of over 30 per cent is of significance), pituitary x-ray, visual fields, sugar tolerance (blood sugar and glycosuria), and tests for the contents of female sex hormone in the blood. By these examinations, however, we are able, in a great number of instances, to catalog a given patient and put her in the hyper- or hypofunctional group of disturbances arising from pituitary, thyroid, or ovary. In the rarer instances, on which I do not propose to focus your attention, the hypofunctions of the adrenal, pancreas and parathyroid may require investigation. I might add that hyperfunctional conditions of these glands are not recognized with the possible exception of hyperactivity of the adrenal cortex in childhood.

It naturally follows that in hyperfunctional conditions of the pituitary, thyroid, or ovary, our efforts should be directed toward toning down the hyperactivity of the affected gland. In the two first men-

tioned glands, complete ablation is contraindicated except in the presence of malignancy. In all three glands less radical toning down of the activity may be obtained by resection, and with the advance in the technic of x-ray therapy, we are able to control the amount of involution produced in the glands with a surprising degree of accuracy. It must not be forgotten that the activities of the glands may sometimes be favorably influenced by less direct measures. Iodine given in case of adolescent goiter usually proves curative, and in the exacerbation of exophthalmic goiter it apparently reduces the toxemia and lowers the basal metabolism, at least temporarily. Ovarian hyperactivity may in rare instances be influenced by reducing external erotic stimuli, by venesection as well as by general hygienic measures. I know of no means of influencing the pituitary gland indirectly, although such attempts have been made.

Hypofunctional conditions require stimulation of the respective glands and this is somewhat more difficult to effect. In the case of the ovary, small doses of x-ray, by killing off persistent atretic follicles frequently increase the ovarian function. This effect is not exerted on the pituitary or thyroid with an equal degree of certainty. In their case substitution therapy must be considered, to which I shall refer in more detail at once.

Naturally in the treatment of any of the symptoms, particularly of nervous ones which arise in the course of endocrine disturbances, purely symptomatic therapy must not be omitted. Loss of weight will require roborant treatment, rest, and increased diet. Obesity, whether accompanied or unaccompanied by thyroid underaction, demands exercise, carefully restricted diet, and usually an entire change of regimen. The assurances of the patient in regard to her physical activity and dietary abstinence are rarely reliable. Nervousness, whether due to thyroid poisoning or not, will require safeguarding from psychic traumas, together with rest and sedatives, among which luminal and bromides have proved the best. Tachycardia, when excessive, will necessitate the use of codeine. Atropine in sufficient dosage, is sovereign in the pains resulting from spastic contractions, especially those complained of in the abdomen and uterus. Adrenalin, pilocarpine, and pituitrin, have one and all proved of little help.

Turning now to direct endocrine organotherapy, our mainstay is thyroid substance. Its exhibition will produce an increase of the basal metabolism and it may therefore be employed to stimulate the life process of a given individual. Its most striking effects are naturally limited to those cases in which the thyroid is underfunctioning; that is, those which show a basal metabolism habitually more than 10 to 15 per cent below the normal. Unfortunately the majority of obese patients show a perfectly normal basal metabolism with, how-

ever, a depression of the ovarian function as our blood studies have shown. Our few attempts to stimulate the ovarian function by means of the female sex hormone are not sufficiently conclusive as yet to permit me to express a definite opinion. In these cases I consider it distinctly unwise to risk giving so-called stimulating doses of x-ray to the ovaries, as the margin of safety is too small. Except when thyroid overactivity is diagnosed a tentative use of small amounts of thyroid extracts is fully justified in order to determine the responses of the given individual to stimulation of the general body metabolism.

I do not propose to discuss the well-known and specific effects of insulin in diabetes although it has proved a boon to the surgeon, permitting operation with impunity even in the presence of severe glycosuria, nor those of the parathyroid hormone in tetany. These drugs appear to be complete or nearly complete substitution products just as the thyroid substance may fully compensate for the loss of the thyroid gland.

As is well known, pituitrin does not in any way replace the loss of the anterior portion of the pituitary gland. Its use in obstetrics, in intestinal paresis, and in diabetes insipidus is too well known to require comment. Attempts to produce an anterior lobe extract have been only partially successful. We know that such extracts in the laboratory can exaggerate the growth impulse of young animals and produce marked lutein overgrowth in the ovaries. Quite recently Zondek has announced that puberty can be ushered in by the implantation of adult (male or female) anterior lobe substance in the youthful mouse, an observation, which, if confirmed, proves that interrelation and interaction of glands can take place. However, no extract is at present available for therapeutic use.

In conclusion, I want to refer to the effect of active female sex hormone extracts in the human female, a chapter of therapy which is just beginning. Our position for accurately studying and evaluating the results obtainable with this extract is especially favorable because not only do we possess specific tests for identifying the female sex hormone as such, but also a diagnostic method which enables us to determine its degree of concentration in the circulating blood. Knowing also the source of the active substance, which is found in the follicle, corpus luteum, and placenta (the three forming the "gestational gland") the criteria demanded by the most exacting pharmacologist can be satisfied.

A number of investigators including Zondek, in Berlin, Pratt, in Detroit, my coworkers and myself in New York and Denver, have been tentatively trying out such preparations as we could produce or obtain. A few of the pharmaceutical houses are also preparing, for experimental use, weak but yet slightly potent preparations. I shall

confine my remarks to my own personal observations which are not numerous but extremely promising.

The extracts which we have used have been prepared in Denver by my coworkers, Dr. Gustavsons, H. Krueger, etc., and employed here in New York with the collaboration of Dr. M. A. Goldberger. The most potent extracts at our disposal have allowed us to inject from three to five rat units per day, which correspond roughly to from twenty-five to forty mouse units, which is the strength measure used by Zondek. Among the patients treated were some in whom menstruation never had occurred although they had reached adult age and their genitals were approximately normal to pelvic examination. A number of patients with persistent amenorrhea, in whom the absence of cyclical phenomena were assured by our blood test, were likewise injected. Two patients with conspicuous facial and body hirsutes are at present under treatment. I may say that all of these patients, after a week or ten days of daily injections, complain of tingling and fullness in the breasts and abdominal cramps. Upon withdrawal of the injections, these symptoms disappear without the appearance of the hoped-for menstrual bleeding. A number of patients volunteered the information that they feel stimulated in every way. This was most striking in a young girl with many stigmas of degeneration and infantilism, underweight and below par in every respect. However, such symptoms, although the patients are not enlightened as to what they may expect, and although everyone has described the same subjective phenomena, are not considered conclusive evidence by us, because we refuse to be influenced by criteria that are not strictly objective. In two patients with kraurosis of the vulva, one of whom had never menstruated and in whom vulvectomy was followed by a recurrence of the kraurotic atrophy and intense pruritus, immediate and as yet persisting relief of the itching was obtained. In both the mucous membrane and the vulvar outlet has assumed a different aspect, the dry, atrophic mucosa and skin showing normal vascularization and normal softness and moisture. In a third patient on whom a preparation obtained from an outside source was used, the treatment signally failed. One patient in whom a high blood pressure developed shortly after double oophorectomy, showed no reduction in the hypertension after two weeks of daily injection.

The female sex hormone as a therapeutic agent must therefore be considered as still in an entirely experimental stage. The outlook for it, however, would be extremely promising were it not for the great difficulty of obtaining concentrated solutions as well as of the great expense involved in purchasing the raw material, fresh ovaries now marketing at the price of over one dollar per pound.

In spite of many obstacles, endocrine therapy has at last emerged

from the unsatisfactory empiric stage. It has been placed upon a rational basis. Thyroid substance and thyroxin, insulin, parathyroid hormone, are well-established pharmacologic products. Adrenalin and pituitrin subserve limited, well-defined purposes. The female sex hormone is available in small amount for experimental and clinical investigation. Anterior lobe pituitary, adrenal cortex and testicular hormone are being studied. No decision as to the function, the potency or impotence of the thymus has yet been arrived at. And there we must leave the question for the present. The future promises great and rapid strides. Let us hope that this cheerful outlook will not again be dimmed by the uncritical acceptance of hearsay evidence by the enthusiast.

#### ADDENDUM

In reply to the various points brought out in the discussion, I would add that the so-called stimulating dose of x-ray is particularly to be avoided in cases of amenorrhea in which obesity coexists, as the margin of safety appears especially small in this type.

The question of giving desiccated whole ovary has repeatedly been raised. For the sake of argument let us say, and this is a most conservative estimate, that 100 grams of fresh sow's ovaries contain approximately 10 rat units if properly extracted and given hypodermically. This same amount of material given by mouth exerts only 1/20 of the parenteral effect. The simple mathematic result of multiplying 100 by 20 shows that 2 kilograms of fresh ovary would have to be swallowed by an unfortunate patient per day to exert a possible influence.

The question of sterility was raised in connection with the possibility that a key to the problem might be found in the basal metabolism. We have found as many sterile patients, and this includes only the group in which the husband is potent and the tubes found patent, who have a normal or an accelerated metabolism as those who have a minus basal metabolism.

I would like to emphasize that to obtain even the most exact data about a given patient is insufficient, because the interpretation and evaluation of the facts is so often difficult, misleading, or absolutely impossible. In regard to using the flushes of the menopause as a guiding symptom on the effect of therapy, I would simply say that close attention will show that as many patients who have not yet reached the menopause and whose sexual organs are functioning normally, suffer from flushes, as women who have artificial or physiologic menopause symptoms. These flushes may be classified as a symptom of autonomic imbalance.

Finally the case report of the gentleman who closed the discussion was highly illuminating just as he intended it to be. He told of a patient from whom both ovaries were removed, to whom he gave an extract of human corpus luteum, and the patient then became pregnant. Naturally his sole and kindly object in presenting this case was to reinforce my contention that the evaluation of seemingly incontrovertible data is so often misleading and impossible. Here an experienced and skilled operator felt sure that he had removed both ovaries but as is evident and as he emphasized some remnant was left behind which later regenerated and gave rise to the ovum which became impregnated.

# A CASE OF RECURRENT TORSION OF THE FALLOPIAN TUBE WITH HEMATOSALPINX\*

By JOHN CASAGRANDE, M.D., BROOKLYN, N. Y.

THIS case is reported because it might be properly discussed as torsion of a normal fallopian tube of which there are only a few cases in the literature, the hematosalpinx apparently resulting from the torsion.

A thirty-six-year old multipara was admitted to the Brooklyn Hospital December 9, 1926, complaining of pain in the lower right abdomen. She had always been well except for an attack of influenza in 1918. Her menstruation was regular and painless, the last period on November 30, 1926. She had three uncomplicated spontaneous labors, the last, nine years ago; three abortions (two were induced), the last

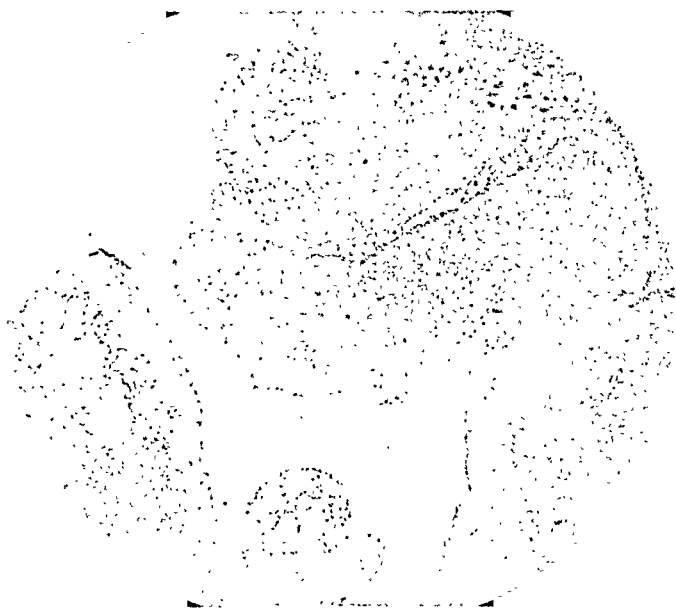


Fig. 1.—Lumen of fallopian tube showing swollen plicae, with hemorrhage and edema; no organized tissue elements.

occurred in June, 1926, was spontaneous, and because of irregular bleeding which persisted, she was curetted at the Brooklyn Hospital, June 25, 1926. The discharge examination at this time revealed nothing abnormal in the pelvis. She had no febrile convalescences following any of her labors or abortions.

The first attack of the present illness began suddenly about the end of October, 1926 with a severe intermittent cramp-like pain in the lower right abdomen, which extended down the anterior side of the thigh and was accompanied by nausea and vomiting. At the end of thirty-six hours, the pain disappeared suddenly, and the following day her menstruation began. A vaginal examination then disclosed a cystic mass in the right fornix, measuring about 6 cm. in diameter; it was not tender. Abdominal palpation was negative.

\*Read at a meeting of the Brooklyn Gynecological Society, March 4, 1927.



She remained entirely free from pain until the second attack, which occurred about six weeks later, December 8, 1926. The onset of this attack was similar to the first, but the pain was more severe and persistent. She entered the hospital the following day and remained under observation four days, during which time her pain gradually diminished.

Physical examination on entering the hospital disclosed that the patient was apparently suffering from pain; the right thigh was flexed on the body. There was rigidity of the lower right rectus and also tenderness in this region. A bimanual examination showed a parous introitus; the cervix had a bilateral laceration; the uterus was of normal size anteriorly but was pushed slightly to the left. The left tube and ovary were neither palpable nor tender. In the right fornix, there was a globular cystic mass of the size found previously, which was so exquisitely tender that no attempt to test its mobility was made. Her temperature varied from 100 to 101° F. The blood count on admission showed 12,600 leucocytes, a differential count of 88 per cent polymorphonuclear, 12 per cent small lymphocytes, hemoglobin

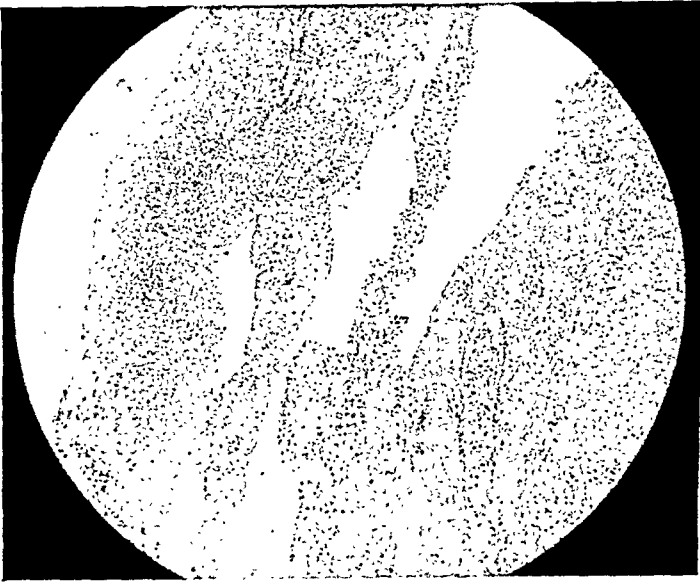


Fig. 2.—Another portion of tube, with some inflammatory infiltration.

82 per cent, and 4,640,000 red blood cells; coagulation time was 5½ minutes. Two days later, there were 14,500 leucocytes with 80 per cent polymorphonuclears and 20 per cent small lymphocytes. The urine was negative. The clinical impression during the first attack was ovarian cyst with a twisted pedicle; during the second attack a similar diagnosis was made plus a localized peritonitis.

On the fifth day after admission, a laparotomy was done. There was no blood or free fluid in the peritoneal cavity. The omentum was wrapped about the entire mass in the right side of the pelvis by fibrinous adhesions which were readily freed, exposing a bluish black globular right tube, the distal third of which was greatly distended, having a diameter of 8 cm., and filled with liquid blood. In the remaining portion of the tube, there were three complete twists. The right ovary contained numerous small cysts. The right broad ligament was abnormally long, having an elongated mesosalpinx. The right tube and ovary were removed. Appendectomy was done. Left tube and ovary were normal.

Her convalescence was uneventful, with primary union. She was discharged on the nineteenth day following operation, at which time the uterus was anterior; no tenderness or induration was present in either fornix.

A recent bimanual examination disclosed the same findings as on the hospital discharge examination. Her menstrual periods have been regular with a moderate dysmenorrhea.

The pathologic diagnosis was: necrosis and hemorrhage of the fallopian tube, follicular cysts of the ovary, and fibrinous periappendicitis.

The specimen consists of a cystic mass, measuring 8 cm. in diameter, which is covered with fibrinous and hemorrhagic adhesions. On the surface the tube can be made out; cross-sections, however, show no structure of tube. On opening the cystic mass, the cavity is filled with old and recent blood. The wall is necrotic. The portion of the tube not distended consists similarly of hemorrhagic black tissue without any structure. The ovary contains numerous small cysts, the largest measuring 2 cm. in diameter, having a hemorrhagic content and a smooth lining. The appendix is 5 cm. in length. The serosa is much congested. Cross-section shows a thick fibrinous and edematous wall. Microscopic sections of the cystic tube show no organized tissue that can be recognized; there is extensive polymorphonuclear infiltration. No decidua tissue was demonstrable. Section of the appendix shows fibrin and polymorphonuclear infiltration of the serosa.

#### COMMENT

Torsion of the normal fallopian tube is a comparatively rare condition. Darner has been able to find reports of only twelve authentic cases in the literature; however, in conjunction with ovarian cysts with twisted pedicles and pathologic changes in the tube, such as tubal pregnancy, hydrosalpinx, pyosalpinx or neoplasms, it is quite common. Anspach, who reviewed the literature in 1921, was able to find eighty-seven such cases. The mechanism of torsion of the normal fallopian tube may be explained by the theory of Payr, who experimentally showed that venous congestion in a pedicle is conducive to torsion. This has also been described by Anspach. Payr injected the veins of the pedicle of a spleen that had been removed from the body and was able to produce a torsion of  $125^{\circ}$ , which he attributed to the fact that the veins of the pedicle are longer and more flexible than the arteries, and under the influence of passive congestion assume a spiral course and so tend to impart a twisting motion to the tumor. Smith and Butler, in a review of fourteen cases of apparently normal tubes which had undergone torsion, excluding those that occurred before puberty and during pregnancy, found that five out of the seven remaining cases occurred in close relation to the menstrual period.

In reviewing the literature, it appears that a large percentage of twisted tubes has an abnormally long mesosalpinx. In the case just reported, the two factors which appear necessary to bring on an attack were present; namely, a long mesosalpinx and circulatory disturbances caused by premenstrual hyperemia.

The subjective symptoms generally begin suddenly with severe pain in the right or left iliac fossa. Nausea and vomiting are very apt to follow the pain. Urinary disturbances, such as frequency, dysuria, and retention are common. If the tube readjusts itself these symptoms will completely subside; on the other hand, if the tube does not un-

twist the symptoms will continue. The objective signs will depend on the resulting pathology. If the process of torsion continues, there will be elevation of temperature, increase in pulse rate, leucocytosis, and a cystic mass will be palpated. The treatment is operation. If this is deferred too long, there may result a rupture of the tube or gangrene followed by peritonitis, or the tube may organize as a cystic or fibrous mass.

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30 PIERREPONT STREET.

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## A CASE OF SYMPUS DIPUS

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(*From the Clinic of the Woman's Hospital*)

IT SEEMS from a fairly extensive survey of the literature that the occurrence of cases of sympos dipus is numerically somewhat uncertain, inasmuch as many authors assert their rarity, whereas more recently another mentions over seventy cases. Furthermore, there appears to be a dissension as to the exact classification of the cases, especially when more than one bone is missing from the thigh or leg. Many cases, thus, are classified as sympos dipus, when they really belong to the group of sympos monopus. According to Foerster, whose classification is most generally accepted nowadays, the monopus variety shows either a single, thick femur, occasionally with doubled epiphyses, or two femora, either closely pressed to each other or fused. There is only one bone present in the lower leg—sometimes a rudimentary second one; the foot is either defective or single or incompletely doubled. The dipus variety shows always two femora which are in closest contact, and two sets of bones in the lower leg; but sometimes only one fibula is present. In fact, the number of authentic and thoroughly studied cases of sympos dipus is rather small, and thus prompts the publication of this case.

The mother, twenty-three years old, Hebrew, has a negative family history; her husband's family history is also negative. At sixteen years she had scarlet fever, without complications. She has no previous obstetric record. Her last regular period was October 6, 1925. She had nausea and vomiting for the first two weeks, but afterwards her pregnancy had a normal course. Life was last felt on May 28, 1926 (eighth month). Labor pains started on June 6, 1926, when she was admitted to the Woman's Hospital. The foot presented; no life could be felt. The delivery was easy; the recovery of the mother uneventful.

The child was a monstrosity, known as sympus. The placenta was normal, also the amount of amniotic fluid. An autopsy was performed and these findings were recorded.

The newborn was apparently of the male sex. It measured from head to buttocks 27 cm., from buttocks to toes 20 cm. The umbilical cord contained one vein and only one artery. As far downward as the hip, no external anomalies were visible except that the right thumb was attached only by a thin bridge of skin, which made this finger more movable than the rest.

There was only one lower limb present, fixed at an angle of approximately  $100^{\circ}$ . The part of the limb which corresponds to the thigh measured 9.5 cm. in length,



Fig. 1.—Side view. Note the angle between the trunk and the lower limb, also the ridge carrying one of the fourth toes.

whereas the distance from the knee joint to the toes was 10.5 cm. Only one bone could be felt in the part corresponding to the thigh; in the lower portion of the limb three bones were palpable, apparently two tibiae lying laterally, and one fibula medially and posteriorly. In the region of the knee joint two lateral protrusions, suggesting two patellae, were visible. The circumference of the knee joint was 9 cm., of the ankle 5 cm. The knee joint was ankylosed, as well as the ankle joints. In the midline of the limb anteriorly a shallow groove was visible, extending downwards over the whole length. The patellae pointed backwards, while the popliteal space pointed towards the abdomen. The heels were also fused and faced anteriorly, as well as the soles of the feet. The two feet were united at the originally outer edges, forming a sharp ridge, which points backwards. The large toes were situated laterally. There were eight toes present; the first, second,

and third toes looked normal, whereas the fourth toes were placed one behind the other. The ridge carried one of those toes.

A distinct scoliosis to the left and a kyphosis were visible, both most marked in the upper thoracic region. A lordosis was present in the lower lumbar region. The anal opening was situated somewhat higher than normal and was not patent for a probe. Below this anal opening was a small raphe of 1 cm. length, with a small penis-like formation, (0.8 cm.) at its end. Its free end was split into two small cone-shaped protrusions. Below this formation the scrotum, the size of a small pea, was visible, but it did not seem to contain the testicles. Two centimeters above the anal opening was a shallow groove in the skin, not covered with hair. The head was normal. The lungs appeared normal; they did not float on water. The thymus weighed 8 grams. The heart was broader than usual, the apex was bifid. The ventricles and auricles, and also the valves were normal. At a distance of 1.5 cm. from its origin from the ventricle, the aorta became very narrow. This portion measured 2 mm. in length and 4 mm. in diameter, when opened. After this constricted portion the vessel continued its course in the descending part of the aorta.

Upon opening the abdomen, a much dilated portion of the intestine hid the greater part of the abdominal organs, the situs of which otherwise was normal. The terminal portion of the intestine, comprising the sigmoid and the upper part of

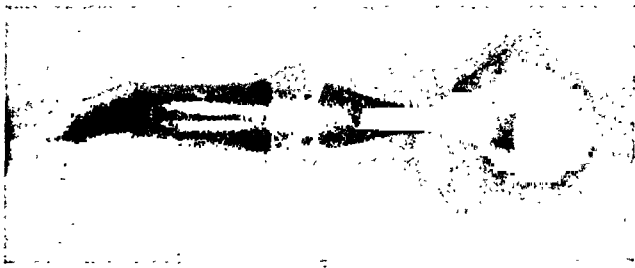


Fig. 2.—Roentgenogram of the lower limb. It shows the fusion of the femora, the two Beclard's centers of ossification at their epiphyses, the two tibiae, and the single fibula.

the rectum, ended blindly in a conical stump. It was much enlarged, and was apparently filled with meconium. No kidneys were found, although the suprarenal bodies were in their normal positions. Attached to the under-surface of the left suprarenal was a small cystic body. Extending downwards from each suprarenal into the pelvic cavity was a duct of about 1 mm. diameter and approximately 4 to 5 cm. long; these ducts ended in a small oblong body situated near the occluded end of the intestine and at the bottom of the somewhat funnel-shaped pelvic cavity. This body is connected with the end of the intestine by loose connective tissue. On each side of the spine, on a level with the pelvic brim, and situated in the posterior part of the pelvic cavity, a normal testicle with attached epididymis was found. Their ductus deferentes likewise terminated in the above-mentioned oblong body in the pelvic cavity. The urachus extended from the umbilicus to this same body. No bladder or internal portion of urethra could be detected.

Roentgenograms of the body show the kyphoscoliosis of the thoracic and the lordosis of the lumbar portion of the spinal column. The vertebrae and the ribs showed no anomalies. Owing to the sharp angle and the ankylosis at the hip joint, it was difficult to get exact and instructive pictures of the pelvic bones, but the pubic bones were separated from each other in front by a wide space, and the sacrum was separated from the iliac bones. The femora were fused; their heads and trochanters were not visible, being probably cartilaginous. The upper portion of the fused shaft was somewhat broader than the middle portion; towards the lower one the shaft became very broad and chisel-like; there was a shallow groove

in the middle of the lower border of the femur. Slightly below this border and near the right and left outer edge a round, dense shadow indicated apparently the Bécord's center of ossification. The patellae were not visible. Two tibiae and one fibula were present. Directly under the lower end of the right tibia near the midline a large, round, dense shadow was visible and seven or eight metatarsal bones. The shadows of the phalanges were overlapping, and therefore, their exact number could not be ascertained. The metacarpus of the thumb could not be seen; there was one indistinct shadow in each phalanx.

*Diagnosis:* Monstrosity: Sympos dipus. Single umbilical artery. Hypoplasia of penis (diphallus partialis). Stenosis of isthmus aortae with patent ductus Botalli. Aplasia of right kidney, hypoplasia of left kidney. Atresia recti and ani. Aplasia of bladder. Bilateral retained testicles. Malformation of right thumb.

The interesting feature about this is not so much the fusion of the lower extremities, as the wide range of variety in the malformations of the internal organs. The changes in the urogenital system are similar to those of many other cases, also the malformation of the intestinal tract; both are almost constant features in sympos cases. What is different about our case and makes it somewhat rarer is the malformation of the heart and thumb, in addition to the other changes, as generally these changes occur only in the caudal portion of the body. The only almost constant feature in sympos is the single umbilical artery, and again single median umbilical arteries arising from the abdominal aorta so far have only been found in sympos. This is the pivotal point when we turn to the explanation of the causes of these malformations. Of all the theories which have been brought forward,—and they are far too numerous to be dealt with in this short report,—two are most outstanding, namely, Weigert's and Bolk's theories. Weigert (1886) asserts that this single umbilical artery arising directly from the aorta before its division is the persistent omphalomesenteric artery. As already mentioned, this single artery is present in almost all cases of sympos, and only in these monstrosities, and this could naturally lead to the conclusion that this arterial anomaly is the primary cause for the formation of the monstrosity. Weigert thinks that the other malformations are only secondary, due to malnutrition as a result of the impaired blood supply. The proof that the omphalomesenteric artery can persist together with both umbilical arteries has been furnished through at least one cause (Angenete). This theory of Weigert is opposed by many who take sides with Bolk. This author attributes the malformations to disturbances which affect the lower segments in earlier embryonic life and thus prevent the division of the lower extremities. His theory is very interesting, although in many points disputable, and he sees the causal origin in changes of the germ-plasm. This means that mechanical hindrances are considered by Bolk the main factors in the formation of these defects, whereas Weigert's theory is based upon an impaired blood supply and its sequelae. Which of the two theories is

the more plausible is difficult to decide, because both contain many well-founded points of explanation. In our case no facts for a sufficient explanation can be found, and it has simply to be added as another contribution to the list of cases of unsolved mysteries in congenital malformations.

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## BIOCHEMICAL STUDIES OF HUMAN SEMEN AND ITS RELATION TO MUCUS OF THE CERVIX UTERI\*

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### I. INTRODUCTION

WHEN the cervix of the uterus is examined by means of a speculum, a plug of mucus can be seen filling the external os. This plug is especially marked during pregnancy. The mucus fills the entire cervical canal and has the following characteristics: It is gelatinous in appearance, very viscous and adhesive in that it adheres tenaciously to either instrument or cotton applicator. When the mucus is pulled away from the cervix, it forms a slimy string which is broken with difficulty. In virgins and in those who do not present any pelvic pathology the mucus is semitransparent; but where there is a pelvic lesion such as an infection, a laceration, an eversion or erosion present, the cervical mucus becomes mucopurulent in character and probably more adhesive.

When one considers the passage of spermatozoa upwards by means of their own motility through the cervical canal filled with mucus, it becomes evident that there must exist some mechanism by means of which the character of the mucus is changed, so that it is no longer adhesive. For it is difficult to conceive of spermatozoa moving through such a gelatinous medium. The following experiments will show that there is present in the human semen a substance that changes cervical

\*This paper is part of a thesis submitted by Dr. Raphael Kurzrok, in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Faculty of Pure Science, Columbia University.

mucus from a viscous to a nonviscous compound and then dissolves it completely. The presence of this lytic substance may explain the mechanism by which spermatozoa are able to pass through the cervical canal into the cavum uteri.

The object of this work is to study certain phases of the chemistry of the semen and mucus, and to present data which may provide a deeper insight into the very important problem of human sterility by showing the existence of other possible etiologic factors of sterility.\*

## II. EXPERIMENTAL

*A. The Collection of Material.*—Semen was collected from healthy young males who were known not to have had either gonorrhea or syphilis. The semen was procured by means of the condom. Occasionally we were able to get friction specimens, the injection being made directly into a sterile container. Immediately after collection the semen was packed in ice and used for experimental purposes within twelve hours. Specimens older than twelve hours or not preserved properly in the cold were discarded. When one considers that the average ejaculation yields only from 3 to 4 c.c. of semen, one can understand why during a period of two years we were unable to secure more than 8 c.c. at any one time. Such a relatively large amount of semen we only possessed three times. About 500 properly collected semen specimens were obtained.

We had even less cervical mucus to experiment with. The normal cervix is 2.5 cm. long and its canal is spindle-shaped, being about 4 mm. in diameter at either os and 7 mm. at its center. The mucus was removed from the canal by means of a sterile uterine dressing forceps, after having cleaned the outer surfaces of the cervix with sterile cotton. Attempts at the removal of the mucus by suction led to the contamination of the mucus by blood; hence this method was not employed. The mucus was collected from women who had no pelvic lesion whatsoever. Since most patients in a gynecologic clinic have some form of pelvic pathology, only one patient in about thirty yielded a specimen which was suitable for experimental purposes. All specimens were immediately put into the ice box and used within six hours of collection. The average yield of mucus from a given patient was a fragment about 1.5 cm. long and 4 mm. in diameter, and weighing a fraction of a gram. On only a few occasions were we able to obtain several such specimens at one time. Another difficulty in the collection of the material was that on occasions when we had semen we were unable to get mucus, and vice versa. Furthermore, specimens from patients who had had natural intercourse within forty-eight hours were discarded for reasons which will be given below. In addi-

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\*We wish to thank Dr. I. C. Rubin who furnished us with a considerable amount of the material used during the first year of the work.



tion, no douching was allowed for two days before the collection of the specimen. About 300 proper specimens were obtained.

*B. The Action of Semen on Cervical Mucus.*—A freshly collected semen specimen containing about 3 c.c. was diluted with an equal amount of distilled water. A specimen of cervical mucus was divided into several fragments each measuring about 5 mm. by 3 mm. The mucus was then dropped into a test tube containing 2 c.c. of either 0.25 per cent sodium carbonate, or distilled water, or physiologic saline. To each tube was added 0.5 c.c. of semen diluted as above (or in some cases undiluted). Several drops of toluol or acetone were then added as a preservative. The tubes were stoppered with cotton and incubated at 37.5° for twenty-four hours. Table I shows the result of one such experiment.

TABLE I. SEMEN PLUS CERVICAL MUCUS

SUSPENSION FLUID	SEMEN	MUCUS	INCUBATION	DIGESTION RESULT
Distilled water	0.5 c.c.	shred	24 hr.	Complete digestion 3 plus
Distilled water	0	shred	24 hr.	No digestion 0
0.25 per cent sod. carbonate	0.5 c.c.	shred	24 hr.	Complete digestion 3 plus
0.25 per cent sod. carbonate	0	shred	24 hr.	No digestion 0
Physiol. Saline	0.5 c.c.	shred	24 hr.	Complete digestion 3 plus
Physiol. Saline	0	shred	24 hr.	No digestion 0

In all digestion experiments the following symbols will be used to denote the degree of digestion:

- 3 plus—Complete digestion. No mucus remains.
- 2 plus—Partial digestion. Slight fragment remains.
- 1 plus—slight digestion. Larger fragment remains.
- 0 —No digestion whatsoever. Entire fragment remains.

These tests showed that there was present in semen a substance which had a lytic effect upon a viscous cohesive mass of cervical mucus. The control fluids without semen had no action upon cervical mucus.

If the experiment was observed at regular intervals during the period of incubation, the following facts were noted: Within a half hour the mucus in those tubes containing semen had lost its glassy gelatinous appearance and had become dull. The edges of the shred became frayed and hazy in appearance. Finally after a period varying from twelve to twenty-four hours, depending on the activity of the semen, the mucous shred disappeared completely. In the control

tubes which did not contain semen the mucous shred remained the same size throughout and never lost its glassy and gelatinous appearance. The digested tubes, i.e., those which contained semen, showed a slight precipitate which upon microscopic examination was found to consist of dead spermatozoa, crystals, leucocytes, and epithelial cells, there being no sign of the mucus. Occasionally at the end of digestion there was seen floating in the solution a hazy faint cloud-like shred of mucus which upon gentle shaking disappeared completely.

C. *The Nature of the Lytic Substance in Semen.*—1. *The lytic substance was apparently specific for the mucin.* Using the technic as described, semen was allowed to act upon small shreds of egg white, casein, and fibrin. To each tube except the controls was added 0.5 c.c. of undiluted semen. Incubation was for twenty-four hours. Preservative was toluol.

TABLE 11. SEMEN AND OTHER PROTEINS

SOLUTION	SEMEN	PROTEIN	DIGESTION RESULT
0.25% Sod. Carbonate	0.5 c.c.	cervical mucus	3 plus
0.25% Sod. Carbonate	0.5 c.c.	cervical mucus	3 plus
0.25% Sod. Carbonate	0.5 c.c.	fibrin	0
0.25% Sod. Carbonate	0.5 c.c.	fibrin	0
0.25% Sod. Carbonate	0.5 c.c.	egg white	0
0.25% Sod. Carbonate	0.5 c.c.	egg white	0
0.25% Sod. Carbonate	0.5 c.c.	casein	0
0.25% Sod. Carbonate	0.5 c.c.	casein	0
0.25% Sod. Carbonate	0	cervical mucus	0
Distilled Water	0	cervical mucus	0

The experiment (Table 11) was repeated in media of varying  $P_H$ , both acid and alkali, with the same results. Semen did not digest casein, fibrin or egg white, under conditions at which it digested cervical mucus. The mucus is only with difficulty digestible by pepsin or trypsin.

2. *The lytic substance did not digest other types of mucin such as salivary or respiratory mucin.*

We were able to secure flakes of mucus prepared from the submaxillary gland.\* The respiratory mucus was obtained by cough in a case of mild bronchitis. The sample was a sticky glairy shred somewhat

\*The submaxillary mucin was kindly given to us by Dr. James Inouye of the Department of Biochemistry.

gray in color. The semen was used undiluted. Incubation was for twenty-four hours. Preservative was toluol. This experiment showed that under identical conditions semen did not digest mucin from the respiratory tract or the submaxillary gland, but did digest the cervical material.

TABLE III. THERMOLABILITY OF LYTIC SUBSTANCE

SOLUTION	SEMEN	MUCUS	DURATION OF BOILING	DIGESTION RESULT
Phys. sal.	0.5 c.c.	shred	10 min.	2 plus
Phys. sal.	0.5 c.c.	shred	20 min.	doubtful
Phys. sal.	0.5 c.c.	shred	30 min.	0
Phys. sal.	0.5 c.c.	shred	60 min.	0
Phys. sal.	0.5 c.c.	several shreds	0	3 plus
Phys. sal.	0	shred	0	0

### 3. *The lytic substance is thermolabile.*

The semen in this experiment was diluted with an equal volume of distilled water and boiled in a water-bath for various periods. It was then cooled and added to the cervical mucus and physiologic saline. Toluol was the preservative. The incubation period was twenty-four hours. Results of one typical experiment are shown in Table III.

This experiment showed that the lytic substance was thermolabile, and that boiling for thirty minutes on a water-bath was necessary before the substance was entirely destroyed. The tube containing the semen boiled only for twenty minutes showed doubtful digestion. The mucus had merely become less glassy and very slightly frayed at the edges, but did not diminish in size.

### 4. *The lytic substance did not deteriorate after five days in the cold.*

To a semen specimen several drops of toluol were added and the specimen placed in the ice box.

TABLE IV. LYTIC SUBSTANCE AND AGING

SOLUTION	SEMEN	MUCUS	DIGESTION RESULT
Phys. sal.	5 days old	shred	3 plus
	0.5 c.c.		
Phys. sal.	Fresh	shred	3 plus
	0.5 c.c.		
Phys. sal.	0	shred	0

This experiment demonstrated that semen which had aged for five days in an ice box and preserved by toluol, still maintained its ability to digest cervical mucus completely.

### 5. *The lytic substance was precipitated by phosphomolybdic acid.*

A specimen of semen was diluted with an equal amount of distilled water. To this phosphomolybdic acid was added drop by drop until no further precipitate appeared. The precipitate was voluminous, and the

supernatant fluid was clear with a faint yellowish tinge. The precipitate was filtered off and suspended in distilled water. The filtrate was used as such. Incubation was for twenty-four hours; toluol was used.

The results showed that the lytic substance was precipitated almost completely by phosphomolybdic acid, and that when the precipitate was resuspended in water it was still active. The action of the filtrate was doubtful. There was a slight fraying of the edges of the mucus but the fragment remained the same size. It is possible that not all of the lytic substance was precipitated by the single treatment with phosphomolybdic acid.

TABLE V. DIALYSIS OF SEMEN

SOLUTION	SEMEN	MUCUS	DIGESTION RESULT
Phys. sal.	0	shred	0
Phys. sal.	dialysate 2 c.c.	shred	0
Phys. sal.	dialysate 5 c.c.	shred	0
Phys. sal.	residue 2 c.c.	shred	3 plus
Phys. sal.	dial. 2 c.c. res. 2 c.c.	shred	3 plus

6. *The lytic substance did not dialyze through a collodion membrane.*

Three collodion tubes of 20 c.c. capacity were made. Five c.c. of semen were diluted with 25 c.c. of water and 10 c.c. of this mixture was placed in each of the collodion tubes. All three tubes were suspended in a beaker containing about 50 c.c. of distilled water. This was placed in an ice box for five days. Toluol was used as a preservative both inside and outside of the tubes.

The beaker and its contents were occasionally agitated. After five days the collodion tube showed a small amount of sediment at the bottom and a milky supernatant fluid. By shaking the sediment again became suspended in water. The water outside of the tube was clear and there was a slight sediment at the bottom of the beaker. This was also resuspended by shaking.

This experiment (Table V) showed that the substance in semen which exercised a lytic effect upon cervical mucus did not dialyze through a collodion membrane. The dialysate had no action upon cervical mucus.

7. *The Influence of the  $P_{H}$  on the lytic substance.*

A series of tubes containing 2 c.c. of phosphate buffer mixture was set up and to each was added a shred of mucus of approximately the same size. Both mucus and semen for this experiment came from the same patients. Owing to the insufficiency of material, the experiment was run in three stages of about one week apart.

These experiments (a typical result is given in Table VI) showed that at a  $P_H$  of 5.28 to 5.90 the lytic substance in semen showed its greatest activity on the acid side of neutrality. From a  $P_H$  of 5.90 to just beyond neutrality there was little digestive action. At a  $P_H$  of 7.37 and 8.04 there was the same optimum lytic activity. Other experiments showed that beyond a  $P_H$  of about 10 both semen and control tubes showed equal digestion, thus showing that the concentration of alkali in both was the causative factor in the digestion. There was no digestion at a  $P_H$  below 4.0.

TABLE VI. THE LYTIC SUBSTANCE AND THE  $P_H$  OF THE MEDIUM

$P_H$	SEMEN	MUCUS	DIGESTION RESULT
5.28	0.75 c.c.	shred	3 plus
5.28	0	shred	0
5.90	0.75 c.c.	shred	3 plus
5.90	0	shred	0
6.64	0.75 c.c.	shred	1 plus
6.64	0	shred	0
6.97	0.75 c.c.	shred	1 plus
6.97	0	shred	0
7.37	0.75 c.c.	shred	3 plus
7.37	0	shred	0
8.04	0.75 c.c.	shred	3 plus
8.04	0	shred	0

8. *The relation of the lytic substance to the presence of spermatozoa in semen and its action in a case of Froehlich's Syndrome.*

Semen specimens were obtained from various patients who presented the following characteristics.

Semen *K* was from a normal fertile individual whose semen was known to digest cervical mucus actively. It contained a normal number of motile spermatozoa.

Semen *R* was obtained from a case presenting a distinct Froehlich's Syndrome. The wife of this patient was normal. Their marriage was sterile. The semen showed a few dead spermatozoa.

Semen *A* was from a patient who had a previous bilateral operation for hydrocele. The semen contained no spermatozoa. His wife was normal. Their marriage was sterile.

Semen *B* was obtained from a patient who had an attack of mumps during childhood. Both testicles were normal. The semen contained a normal number of actively motile spermatozoa. His wife was normal. Their marriage was sterile.

Semen *Ar* was obtained from a normal male. Numerous motile spermatozoa. His wife had an uncorrected adherent retroversion and their sterility was accounted for by the pelvic lesion in the wife.

All the cervical mucus used in this experiment was from a single patient; hence the experiment was carried on for over a period of a number of weeks.

These experiments (Table VII) demonstrated the following: The activity of the lytic substance did not depend on the presence of spermatozoa. Case A had no spermatozoa yet the lytic activity of the semen was normal. Case B had a normal number of motile spermatozoa, yet the lytic activity was only slight. In a case of Froelich's Syndrome the spermatozoa were few and dead and the lytic activity was very slight.

TABLE VII. THE LYTIC SUBSTANCE AND THE PRESENCE OF SPERMATOZOA

SOLUTION	SEMEN	MUCUS	SPERMATOZOA	DIGESTION RESULT
Sod. carb.	K	shred	normal, living	3 plus
Dis. water	K	shred	normal, living	3 plus
Sod. carb.	R.	shred	very few, dead	1 plus
Dis. water	R	shred	very few, dead	1 plus
Sod. carb.	A.	shred	none	3 plus
Dis. water	A	shred	none	3 plus
Sod. carb.	B	shred	normal, living	1 plus
Dis. water	B	shred	normal, living	1 plus
Sod. carb.	Ar.	shred	normal living	3 plus
Dis. water	Ar.	shred	normal living	3 plus
Sod. carb.	none	shred	-----	0
Dis. water	none	shred	-----	0

#### 9. The lytic action occurred both *in vivo* and *in vitro*.

A specimen of mucus was obtained from a patient eight hours after natural coitus. There was no douching following this intercourse. Mucus from this patient had been used on other occasions for some experiments, and was completely digested by the semen of her husband. All previous experiments were in test tubes and properly controlled.

TABLE VIII. ACTION OF SEMEN IN VIVO AND VITRO

P <sub>H</sub>	DIGESTION RESULT
5.58	3 plus
6.97	3 plus
8.04	3 plus

The cervix on this occasion was very clean. The mucus was only present in the cervical canal, was very small in amount, thin, lusterless, and had no adhesive properties. A shred of the mucus was added to 2 c.c. of phosphate mixture. No semen was added. Toluol was the preservative. Incubation was for twenty-four hours.

This experiment (Table VIII) showed that digestion had been going on in the cervical canal and that the partially digested mucus continued to complete digestion *in vitro* at a P<sub>H</sub> ranging from 5.58 to 8.04.

10. *The lytic substance was not found in a bull's testicle.*

A fresh bull's testicle was stripped of its capsule and ground in a meat chopper. To 25 gm. of ground testicle 25 c.c. of distilled water was added and the mixture ground thoroughly with sand. Toluol was added and the extract was allowed to stand in the ice box overnight. It was then strained through cheese cloth and filtered by suction and then used.

The extract was added to the mucus, which had already undergone partial digestion in the cervix as described in the previous experiment and to normal mucus from another patient.

This experiment (Table IX) showed that our extract of bull's testicle did not digest human cervical mucus, and that it stopped digestion in mucous specimens that had already undergone partial digestion in the cervix, and which had undergone complete digestion in test tubes at different hydrogen-ion concentrations without any further addition of semen.

TABLE IX. THE LYTIC SUBSTANCE IS ABSENT IN A BULL'S TESTICLE

P <sub>H</sub>	MUCUS	BULL'S EXTRACT	DIGESTION RESULT
5.58	Partially digested	1.0 c.c.	0
5.58	Partially digested	0	3 plus
6.97	Partially digested	1.0 c.c.	0
6.97	Partially digested	0	3 plus
8.04	Partially digested	1.0 c.c.	0
8.04	Partially digested	0	3 plus
—	Normal not digested mucus	1.0 c.c.	0
—	Normal not digested mucus	2.0 c.c.	0

11. *The activity of the lytic substance is diminished by the presence of pus in the cervical mucus.*

Three types of mucous specimens were used in this experiment. One was from a normal patient. The second specimen was from a patient with a leucorrhoeal discharge due to a lacerated cervix. The mucus had a grayish appearance, was opaque and glistening. The third specimen was from an acute gonorrhea. The mucus was thick, opaque, and was clinically frank pus.

TABLE X. LYTIC ACTIVITY AND CONTAMINATION OF MUCUS

SOLUTION 2 c.c.	SEMEN	MUCUS	DIGESTION AFTER 24 HOURS	DIGESTION AFTER 48 HOURS
Phys. Sal.	0.5 c.c.	Normal	3 plus	
Phys. Sal.	0	Normal	0	
Phys. Sal.	0.5 c.c.	Leucorrhoeal	Doubtful	2 plus
Phys. Sal.	0	Leucorrhoeal	0	0
Phys. Sal.	0.5 c.c.	Gonorrhoeal	0	Doubtful
Phys. Sal.	0	Gonorrhoeal	0	0

This experiment (Table X) demonstrated that as the amount of pus in the mucus increased, the mucus became more resistant to digestion. When frank pus was present there was almost no digestion in forty-eight hours.

12. *The nature of the end-products after the action of semen on cervical mucus.*

An attempt was made to determine how far the mucus was split by the lytic substance in the semen. That some change occurred in the mucus after digestion could be seen from the fact that the digested mucus gave no precipitate with acetic acid. It was thought possible that the prosthetic group—mucoitin sulphuric acid—was split off from the protein fraction of the mucus. In the absence of any reaction that could be used to determine the presence of a very minute quantity of this group, we were unable to test for it. It was impossible to isolate the prosthetic group by the method of Levene in view of the minute quantities of material with which we had to deal.

Thinking that perhaps the mucoitin sulphuric acid was split up, we tested for glycuronic acid by the Tollens naphthoresorcinol reaction. The tests were always negative. We also attempted to test for hexosamine acetic acid by the Ehrlich reaction. The results were inconclusive. Occasionally we felt that we got a positive test for the substance after the mucus had been digested, but a repetition of the experiment under identical conditions, with the semen and mucus from the same patient, failed to give a positive reaction. Since almost nothing is known concerning the protein fraction of mucus, we were unable to approach the problem from that angle in view of our lack of material.

D. *The Reducing Action of Semen on Thionin.*—In efforts to make more evident, visually, the fragmentation of the mucous shred under the influence of semen, we stained the shred, before digestion, with thionin; when this stained shred was subjected to semen action, we noted that the thionin was reduced to a colorless compound. A preliminary study of this reducing power in semen is reported below and will be further continued.

A 0.001 per cent aqueous thionin solution was used. Incubation was at 37.5° C. for twenty-four hours. Toluol was the preservative. Semen was added as noted in Table XI, which gives the results of a typical test. 0.3 c.c. of the thionin solution made up to 2 c.c. with distilled water was used each time.

The thionin was decolorized by the semen.

1. *The decolorizing substance is thermostabile.*

A specimen of semen was boiled for three hours. Before the boiling, and at intervals during it, 0.5 c.c. samples of the semen were removed, added to a thionin solution and incubated for twenty-four hours.



TABLE XI. ACTION OF SEMEN ON THIONIN SOLUTION

THIONIN	SEMEN	RESULT
2.0 c.c.	1.0 c.c.	Colorless
2.0 c.c.	0.5 c.c.	Colorless
2.0 c.c.	0.25 c.c.	Colorless
2.0 c.c.	0	Purple

The experiment (a typical result is given in Table XII) showed that boiling semen for three hours did not destroy its ability to decolorize thionin.

TABLE XII. THERMOSTABILITY OF DECOLORIZING PRINCIPLE

THIONIN	SEMEN 0.5 c.c.	RESULT
2.0 c.c.	Fresh	Colorless
2.0 c.c.	Boiled $\frac{1}{2}$ hour	Colorless
2.0 c.c.	Boiled 1 hour	Colorless
2.0 c.c.	Boiled 2 hours	Colorless
2.0 c.c.	Boiled 3 hours	Colorless
2.0 c.c.	0	Purple

2. *The decolorizing principle is precipitated from semen by phosphomolybdic acid, by saturation with ammonium sulphate, and by 95 per cent alcohol. It is not present in the filtrates from these precipitates.*

To a specimen of semen phosphomolybdic acid was added until no further precipitate resulted. The precipitate was filtered off and suspended in distilled water.

To 3 c.c. of semen an equal volume of 95 per cent alcohol was added. A white precipitate resulted which was filtered off and then suspended in saline. To another specimen an equal amount of distilled water was added and then ammonium sulphate to saturation. A heavy precipitate resulted. The precipitate was suspended in distilled water.

The experiments demonstrated that the decolorizing principle in a semen was precipitated by phosphomolybdic acid, 95 per cent alcohol, and by complete saturation with ammonium sulphate. The filtrates of these precipitates did not contain this principle.

3. *The decolorizing agent passes through a collodion membrane.*

Three c.c. of semen were diluted with 7 c.c. of distilled water and placed into a collodion tube. This was suspended in a beaker containing 25 c.c. of water and allowed to dialyze for five days in an ice box. Both dialysate and residue when added to a thionin solution either separately or together decolorize it.

E. *Other Properties of Semen.*—Human semen, boiled or unboiled, did not cause the production of a blue color with guaiac or benzidin, with or without hydrogen peroxide. This suggests the absence of a peroxidase or oxidase system.

Tests for glutathione\* were uniformly negative in the semen.

Ether-alcohol extraction of semen yielded small amounts of a yellow oily substance. Identification and thorough study has thus far been impossible, because of lack of sufficient amount, but the substance contained lipin material, and in its reaction with bromine or iodine indicated a considerable degree of unsaturation. This unsaturation is perhaps of interest in relation to the hydrogen transport mechanisms involved in the reducing power of the semen.

Semen was found to contain catalase as evidenced by the rapid decomposition of hydrogen peroxide.

### III. DISCUSSION

Sterility is assuming increasing importance, for it has been shown that sterility is on the increase. The problem presents many complexities, and especially complex is the case of the sterile woman whose past history is negative, whose physical condition is good, who presents no endocrine disturbance, has no pelvic pathology, has patent fallopian tubes, and whose husband shows normal motile spermatozoa. When such a patient remains sterile in spite of the usual forms of treatment, one must admit that there are other conditions which must be present before that patient can become pregnant. In other words, there are etiologic factors of sterility which have not been described. The absence or diminution of the lytic substance in semen may be such an etiologic factor.

When spermatozoa are deposited in the posterior culdesac of the vagina, it is essential that they reach the ovum within forty-eight hours after ejaculation. Mall<sup>5</sup> in an excellent paper published after his death, referring to human conception, concluded that it is probable that spermatozoa had lost their fertilizing power by the time they had passed the tube, and that any other conclusion entails many contradictions and unnecessary assumptions. Graf Spee<sup>2</sup> states that the duration of life of spermatozoa in the genital tract of a woman does not exceed twenty-four to thirty-six hours. Bryce and Teacher,<sup>1</sup> and Triepel<sup>11</sup> also concluded that fertilization must occur within forty-eight hours after copulation. Lillie<sup>3</sup> states, "The mere fact that spermatozoa may retain their motility in the human genital tract for three weeks or more (Waldeyer<sup>12</sup>) by no means proves that they re-

\*Other experiments showed that glutathione was present in the testicle of full grown bull. It was present in an early corpus luteum and absent in the remaining portion of the ovary. Glutathione was not found in follicular fluid nor in the ovarian tissue that remained after the fluid was aspirated. A corpus luteum beginning to undergo degeneration did not give the nitroprusside test.

Furthermore in preliminary experimenting with follicular fluid it was found that it dissolved cervical mucus, reduced thionin, and showed the presence of a peroxidase. Semen inhibited the action of the peroxidase. A mixture of semen and follicular fluid did not decolorize thionin. Follicular fluid appeared to have an activating influence upon spermatozoa, and possibly a chemotactic influence.

Semen appears to be very strongly buffered, a fact of considerable clinical significance.

These subjects are still under investigation and will be reported upon subsequently.

tain their fertilizing power all this time, although this has been almost universally believed." Lillie demonstrated conclusively that spermatozoa of marine forms may remain motile for a long time after they have lost their power of fertilization due to the loss of their fertilizing agglutinable substance. Motility, then, is not a criterion of fertility.

When there is complete loss of the lytic substance, spermatozoa cannot pass through the cervical canal into the cavum uteri and then into the fallopian tube. Fertilization does not occur and the patient remains sterile. In the case where the lytic substance is diminished many hours may be lost by the spermatozoa before they can penetrate the column of mucus. By the time they have reached the tube they may have lost their fertilizing power although their motility may remain.

The same explanation holds true when the cervical mucus is contaminated by abnormal discharges. A woman with an acute gonorrhea with its extensive purulent cervical discharge, or with extensive leucorrhea due to tears or disease in the cervix almost never becomes pregnant as long as the discharge lasts. We have demonstrated that the lytic substance will not digest a purulent cervical mucus; hence spermatozoa will not pass through, and the patient will remain sterile. Where the cervical mucus is only partially contaminated, a considerable time may elapse before digestion is sufficient to allow spermatozoa to pass through the cervix. So that here, as above, by the time the spermatozoa have reached the tube their fertilizing power may be lost although their motility may remain. The patient remains sterile.

Rubin<sup>9</sup> has observed clinically that after natural coitus a contaminated cervix looks much cleaner, the mucus having been dissolved. Here, then, we observe clinically the presence of the lytic substance in semen.

The specificity of the lytic substance is a very interesting phenomenon. Not only are proteins such as fibrin, casein, or egg white not digested, but the closely resembling submaxillary and respiratory mucins are also not digested. Just how far cervical mucus varies from the other types of mucus we are unable to state. We have been unable to secure sufficient mucin from nongravid patients in order to make the necessary tests. An attempt will be made to secure mucus from patients in labor, but whether such mucus is the same as the mucus from a nonpregnant cervix, we are not in position to state. On theoretic grounds there is a possibility that cervical mucus varies with the function of the ovary, that is, mucus of the nonparous cervix differs from that of the pregnant cervix and from that in a case of amenorrhea due to endocrine dysfunction.

The fact that the lytic substance is precipitated by phosphomolybdic acid and does not pass through a collodion membrane suggests that it

is associated with the protein fraction of semen. These factors plus its thermolability, its optimal activity at a definite  $P_H$ , and its specificity, point strongly to the supposition that the lytic substance is an enzyme. Considering the complexity and specificity of spermatid fluid, it is not at all surprising to find such a highly specific enzyme in it.

An interesting speculation in this connection is the possible manner in which the sperm penetrates the zona pellucida, a rather thick, highly refractive, clear, glistening membrane immediately surrounding the ovum. Physically, therefore, it resembles mucin. Chemically, according to Minot<sup>7</sup> it (the zona pellucida) is resistant to acids, and soluble in alkalis only with difficulty. This makes its resemblance to mucin still greater. The sperm must penetrate this membrane in order to reach the ovum. Having expended considerable energy to reach the ovum in the tube, it is doubtful whether it could pass through this tough membrane by mere mechanical motion. Granting that the zona pellucida is composed of mucin, a minute trace of this lytic enzyme carried along by the sperm would explain the passage of the sperm through the membrane with an expenditure of but very little energy.

The study of the effect of the  $P_H$  on the lytic substance in semen showed that there are two zones of optimal activity on the hydrogen ion scale. One zone lies on the acid side, at a  $P_H$  between 5.28 and 5.90, and the other at a  $P_H$  between 7.37 and 8.04. There is some activity in the zone between these two peaks. This enzyme varies from the others in that the latter present only one peak on the hydrogen ion scale. But the conditions present in the human genital tract show why two such peaks are necessary. The cervix is constantly discharging mucus into an acid vagina. The vaginal  $P_H$  of the average healthy adult woman is 4.7 (Zwolinski and Truzkowski<sup>15</sup>). The normal cervix dips into the posterior culdesac which, with the woman in the prone position, forms a distinct depression known as the "receptaculum seminis." The injected semen accumulates in this depression, and the external os of the cervix dips into the "Samensee," as it is called by the Germans (Nuernberger<sup>6</sup>). The semen here must act on the cervical mucus which has been in an acid medium, hence the necessity for an enzyme that is able to digest mucus in an acid medium. When the spermatozoa pass into the cervix, they are in an alkaline medium, for the reaction of the cervix is just alkaline to litmus (Zuntz<sup>14</sup>). There is here the necessity for an enzyme that is able to digest mucus in an alkaline medium. The lytic substance in semen, by having an optimal activity on both the acid and basic sides of neutrality, fulfills both of the conditions.\*

\*It is possible that we may be dealing with two enzymes, one acting in an acid and the other in an alkaline medium,

The relation of the lytic substance to the presence of spermatozoa is an important clinical consideration. Taking the case of the patient B. for an illustration: This couple had been married for a number of years, and Mrs. B. never became pregnant. She presented no pelvic lesion, her history was negative, her general health excellent. The semen of the husband showed the presence of a normal number of actively motile spermatozoa. This would have been considered a normal semen specimen, but we have been able to show that this specimen could barely digest cervical mucus. This finding suggests a possible cause for the sterility in this case.

Patient R. presented clinically a Froehlich syndrome. Only a few dead spermatozoa were found in his semen. At the same time his semen digested mucus only slightly. Usually cases of Froelich syndrome are sterile. Whether both deficiencies are present in the semen of cases of Froelich syndrome or only one deficiency, we are unable to state, because this was the only case of this type that we had occasion to observe.

Are all the normal mucous specimens digestible by semen having the lytic enzyme? Up to the present time all normal cervical mucus was found digestible. It is possible that, when more mucus specimens are studied, some may be found to be undigestible by any semen specimen. In the cases where we have been able to match the husband's semen against his own wife's mucus, in fertile couples, digestion always occurs. Again, it is possible that in a very large series of cases, specimens of semen may be found that may be unable to digest the mucus of their wives but may be able to digest the mucus of other women. Such circumstances would explain the cases where a given couple is sterile and upon separation and remarriage to others each party has children. Only a prolonged study of the lytic phenomenon will shed further light on these interesting possibilities.

The fact that we were unable to demonstrate the lytic substance in a bull's testicle does not prove that it is absent there. It is very possible that our methods of extraction were insufficient. It is possible that its origin is elsewhere as in the prostate or seminal vesicles. The isolation of the lytic substance may prove to be of therapeutic value in cases lacking this enzyme. The observation that the addition of testicular extract to digesting mucus stopped further digestion need not be explained on the basis of a species specific inhibitory action. Other factors could have inactivated the lytic enzyme already present in the digesting mucus.

The decolorization of thionin presents probably a hydrogen transport system. The system is thermostabile. Thionin forms the hydrogen acceptor and upon taking up hydrogen forms the leuco base. The properties of the hydrogen donator are its precipitability by ammonium sulphate, 95 per cent alcohol and phosphomolybdic acid. It

is dializable through a collodion membrane. The hydrogen carrier is not glutathione because we have never been able to demonstrate its presence in semen. There is a possibility that it is an unsaturated compound such as we found by the alcohol-ether extraction. It may be of the type of linolenic or arachidonic acid, for each of these compounds has several double linkages.

The function of this activated hydrogen system in semen may be as follows: The lytic substance in semen may, by cytolysis of the zona pellucida, initiate the tremendous oxygen consumption by the ovum (Warburg,<sup>13</sup> Shearer<sup>10</sup>). The membrane may thus become permeable so that, according to Loeb,<sup>4</sup> "certain substances which were previously solid are liquified and allowed to diffuse into the egg, where they start or accelerate the chemical processes underlying development." (Quoted by Marshall.<sup>6</sup>) It has been shown in marine forms that if this cytolysis or oxidation be allowed to go unchecked, the eggs, although they begin to divide, eventually undergo complete cytolysis and die. A second corrective process is necessary to save the life of the cell. Experimentally this corrective life-saving process consists either in stopping oxidation altogether by immersing the eggs in a potassium cyanide solution or by depriving them of oxygen (Marshall). The reducing power of semen would offer a method of depriving the fertilized eggs of an excess of oxidation. Marshall states, "A spermatozoon should contain two substances, namely, a cytolysin and a substance inhibiting the initial cytolysis." The lytic enzyme of human semen may correspond to the cytolysin and the reducing system to the substance inhibiting the initial cytolysis.

These considerations show how complex the problem of sterility is. Not only are anatomic and physiologic factors to be considered but also biochemical. We have been able to gain some insight into a few of these biochemical factors and have demonstrated how one may be recognized clinically. Considering the great number of possibilities wherein the fertilization process may go astray, one wonders why sterility is not even more frequent than it is.

#### IV. SUMMARY

1. There is present in human semen a substance that dissolves human cervical mucus.
2. The properties of this lytic substance suggest that it is an enzyme.
3. Considerations are offered relating this substance to sterility and fertilization.
4. Semen has a strong reducing action on thionin and the possible significance of this reaction is discussed.
5. The reduction phenomenon of semen may have a bearing on the oxidative processes following fertilization.
6. Semen contains neither oxidase nor glutathione.

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## THE ALLEGED SYNERGISM OF MAGNESIUM SULPHATE AND MORPHINE

### A FURTHER COMMUNICATION

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A RECENT article by Gwathmey,<sup>1</sup> which he describes as a reply to an article of mine<sup>2</sup> on the alleged synergism of magnesium sulphate and morphine, places me under the embarrassing necessity of again discussing my work. I shall consider the subject briefly under three heads: (1) a recapitulation of the studies, (2) an examination of the reply, (3) suggestions for the further investigation of the problem.

### RECAPITULATION OF STUDIES

Several years ago I desired to introduce studies of the ether-oil colonic method of inducing anesthesia into our laboratory courses in pharmacology in order that the whole subject of anesthesia might be more completely laid before the student. There was at that time no experimental arrangement available to us for routine laboratory work which satisfactorily demonstrated the part played by the several factors which contribute to success with this method. I therefore undertook a study of the subject upon dogs and was very pleased to observe the ease with which I could invariably induce surgical anesthesia in these animals under conditions identical with those employed in the human except for the fact that the initial dose of morphine had always to be proportionately larger. Completing the arrangement for the routine laboratory demonstration, I then undertook certain independent investigations of the subject. Being impressed by the small amount of ether employed in the method, I undertook to reduce this amount still further by availing myself of the depression induced by

the parenteral introduction of magnesium sulphate. Finding very early, however, certain evidence that the ether was already employed at its minimum effective dose or nearly so, I then directed my attention toward a reduction of the morphine. Here again I employed magnesium sulphate, this time for the synergistic effect that it is alleged to have upon morphine, which effect I firmly believed at that time to have been proved. My early failure, however, to find any evidence of this synergism caused me to turn to a more comprehensive study of the literature for assistance. I was surprised to find there no conclusive evidence whatever that this synergism occurs either in laboratory animals or in man. I therefore undertook a thorough study of the subject, a study in which I am still engaged. I was the more easily enabled to do this by reason of the fortunate circumstance that the colonic anesthesia experimental arrangement lent itself exceedingly well to the purpose. Here was an arrangement in which the coincident employment of certain factors, properly adjusted, always gave a certain result; to wit, morphine sulphate plus ether-oil by the colonic method gives surgical anesthesia. I then addressed myself to a careful study of the part played by each factor in bringing about this result in order that I might definitely fix the amount of sedation accomplished by the morphine. This was necessary if I wished to observe any increase of sedation which might be due to the addition of magnesium sulphate, since we are unable to describe as synergism the effect induced by the addition of one drug to another unless we have first studied the effect of the original drug alone.

As a result of these initial experiments I was able to determine very definitely the amount of sedation always accomplished by the morphine. Briefly summarized the evidence conclusively showed that:

1. When one ounce of a mixture of 75 per cent ether and 25 per cent olive oil per 20 pounds (9 kg.) body weight was introduced into the colon of dogs, one hour after the subcutaneous injection of 0.01 gm. morphine sulphate per kilo body weight, safe and satisfactory surgical anesthesia was induced and maintained for a little more than one hour. (The criteria for this state of anesthesia, employed in all cases, were described in the reports.)

2. When less than the above stated dose of ether-oil was employed, anesthesia was not induced even though the other factors were at their effective points.

3. When less than the above stated time interval was employed, anesthesia was not nearly so satisfactory even though the other factors were at their effective points.

4. When less than the above stated dose of morphine sulphate was employed, anesthesia was not induced even though the other factors were at their effective points. This effective dose of morphine was fractionated and it was shown that only beyond 0.0075 gm. per kilo did light anesthesia begin to appear, and that only when the full dose of 0.01 gm. per kilo was employed did the resultant anesthesia satisfy the criteria for the state used throughout.

Thus, it was shown that in a given experimental arrangement, a given amount of morphine always accomplished a certain amount of



sedation; namely, that amount which was always sufficient to enable the ether to overcome the animal. This was looked upon as establishing the definite sedative power of the morphine under these conditions, and was therefore utilized as the basis for subsequent attempts to raise this power by the addition of magnesium sulphate.

These attempts were comprised in three series of experiments. First, by testing the ability of the magnesium sulphate to raise the sedative power of the morphine in the following arrangement: effective dose of morphine plus magnesium sulphate, effective time interval, less than effective dose of ether-oil. Second, by testing the ability of the magnesium sulphate to raise the sedative power of the morphine in the following arrangement: less than effective dose of morphine, plus magnesium sulphate, effective time interval, effective dose of ether-oil. The dose of morphine was fractionated here in exactly the same way as it had been in the initial experiments in which the effective dose had been determined. Third, by testing the ability of the magnesium sulphate to raise the sedative power of the morphine in the following arrangement: effective dose of morphine plus magnesium sulphate, but the magnesium sulphate given one-half hour before the morphine, effective time interval, effective dose of ether-oil.

Whenever I encountered evidence of an increased sedative power of the morphine it was my intention to counteract the influence of the magnesium sulphate by employing its antagonist, calcium chloride. Had the increased sedation persisted, I should then have felt that I was dealing with a true case of synergism. The opportunity to employ this technic never arose, however, for in no instance was I able to observe such an increase; i.e., in all cases anesthesia was induced only when all factors were adjusted as had been shown to be necessary in the initial studies in which magnesium sulphate had not been employed. Also, a peculiar and still unexplained reaction manifested by the dogs in these experiments, enabled me quite unexpectedly to note that the analgesic power of the morphine was likewise not raised by the magnesium sulphate. Thus, all the dogs given magnesium sulphate began howling when the ether began to be absorbed from the colon, this howling quickly reaching agonal intensity and persisting until the ether-oil was washed out with tap water. In experiments performed outside this series it was easily shown that this reaction, which must have been due to pain, was caused by the coincident presence in the organism of magnesium sulphate and ether, the method of introducing the ether making no difference in the symptoms. Morphine was effective in overcoming this pain and always did so when it was given in that dose which had been previously shown to be its effective sedative dose. The presence of the magnesium sulphate did not enable smaller doses of morphine to overcome this pain; i.e., it

failed to raise the analgesic properties of the drug as it had also failed to raise its sedative power.

In the course of the studies one hundred and thirteen experiments were performed, employing fifty-one animals ranging in weight from 5 to 23.5 kg. Full accounts of the work and the results, briefly summarized above, were published<sup>3</sup> in due detail, together with my two conclusions, the first of which was that the alleged synergism did not occur in the dog.

Turning to the clinical literature, I then pointed out that my reasons for refusing to accept any of the evidence therein offered of the occurrence of this synergism in man were as follows: the failure of most observers to select such phenomena for modification by drug action as would easily lend themselves to sharply drawn comparisons; their disinclination to distinguish clearly between addition and true synergism, and, above all, their tendency to describe as synergism the overwhelming effect seen when abnormally large doses of either drug are given. My second conclusion was, then, that no satisfactory evidence had been brought forward to show that this synergism occurs in man.

In attempting to account for the persistent belief that this synergism does occur in man, in spite of the fact that there is no scientific evidence to prove it, I stated my opinion that it is due to the sincere conviction that the synergism must take place because of the essential nature of the two substances; i.e., the one an indifferent narcotic, the other an alkaloidal narcotic. I then showed, by reviewing in my pages the work of a number of independent investigators, that such predictions cannot be made and that only actual experimental results can be accepted as having any scientific value.

#### EXAMINATION OF THE REPLY

That which alone has enabled science to contribute to the welfare of our present day world is the fact that at once its aims, methods, and obligations are incorporated in its definition. Though capable of being phrased in many different ways, that definition must always be to the effect that science is an orderly arrangement and record of unbiased and accurate observations of phenomena, either with or without an attempt to explain it in terms of other phenomena similarly recorded. Any person engaging in scientific pursuits, whether as neophyte, teacher, or research worker, must early formulate his credo out of some such statement if he is to attain to understanding of the cause he espouses. Obviously it is of the very essence of the definition that science is a plastic thing, slowly growing by hewing away here and adding on there, the two processes being of equal value. Therefore it follows that anyone offering a sincere contribution must necessarily do so in the certain knowledge that he is but furnishing more

material for the chisel, finding his consolation in the secure faith that the new modeling will be done accurately and without bias. So growth proceeds.

I am led to make the above trite observations because it is my belief that now and then a reiteration of first principles is timely. I shall attempt to point out the lanes of attack along which I feel, therefore, that any legitimate scientific reply to my work must proceed.

1. The alleged synergism of magnesium sulphate and morphine is alone being considered. Therefore, any matter not germane to this subject can have no place in the discussion.

2. I have presented detailed accounts of certain investigations of the alleged synergism made by me upon animals, together with a record of my observations and the conclusions drawn therefrom. Issue can be taken with this work only when (a) it can be shown that exactly similar investigations have been made with entirely different results, or when (b) evidence is offered that the subject has been investigated upon animals using an entirely different experimental arrangement, with interpretations at variance with those made by me upon my own experimental arrangement. In either case, regardless of the issue, such work would be only stimulating to further investigations.

3. I have stated the opinion that this synergism has not been shown to occur in man. In controversion of this opinion any evidence offered must show that simple addition, or the use of abnormally large doses of either drug, or the preponderance of the action of one drug over the other, is not being mistaken for synergism.

4. I have contended that prediction of synergism by reason of the nature of the drugs concerned cannot be made. To upset this contention it must be shown that Bürgi's "law," as originally stated and many times modified, is valid.

That Gwathmey has failed to reply convincingly under any of these heads can be shown:

1. The title of his paper is "The Synergism of Magnesium Sulphate and Morphine and the Synergism of Magnesium Sulphate and Ether." Only the alleged synergism of magnesium sulphate and morphine having been considered by me, all that he has to say regarding the synergism of magnesium sulphate and ether, comprising a very large part of his paper, does not apply to the discussion. Likewise, the introduction of a discussion of the combined use of procaine, magnesium sulphate, and morphine, since it throws no light upon the mooted point, has no place.

2. As evidence of the occurrence of this alleged synergism in animals he says: "The synergism between magnesium sulphate and morphine was first observed in the laboratory by E. J. Pellini, of the

University and Bellevue Hospital Medical College, and immediately applied in the clinic, where its value was proved beyond question by trained observers." As a reference for study of this animal work he cites a paper of his own. I have already discussed that paper in one of my previous articles.<sup>3</sup> I take the liberty of quoting what I said at that time: "He (Gwathmey) states that this combination was first suggested to him by Pellini, and from the work they performed together, Gwathmey offers the following as his sole experimental evidence:

"A sufficient number of animal experiments was conducted to prove that one-eighth grain of morphine in 2 c.c. of a 25 per cent solution of chemically pure and sterilized magnesium sulphate, given hypodermically and repeated twice at half-hour intervals, analgised an animal sufficiently for the full force of an artery clamp to be placed anywhere on the skin without being noticed by the subject. The controlled animal, with the same dosage of morphine, was not analgised to anything like this degree."

The size of the animals used is not mentioned, nor is the number of experiments performed stated. Also, to accept the mere statement that the dogs given morphine alone were "not analgised to anything like this degree" as one having any very real scientific value is impossible, especially as it is well known that dogs become markedly insensitive to pinching on even very small doses of morphine, though they will at the same time resist cutting and also show signs of heightened activity of the more superficial reflexes, such as to light and sound.

I feel that this, the only evidence of animal work that he offers, has no scientific value whatever.

3. As evidence that this alleged synergism occurs in man he offers three tables. Table I furnishes data of a case in which the patient experienced greater relief from pain when given morphine plus magnesium sulphate than when given morphine alone. This mere fact does not, however, constitute proof that simple addition did not bring about this result; indeed, the second longest period of relief was experienced in one of the two instances only in which magnesium sulphate alone was used. Tables II and III comprise lists of cases in which the time before postoperative sedative was shown to be longer when morphine plus magnesium sulphate was used preoperatively than when morphine was used alone. Here again there is no evidence of synergism. Both experimental and clinical literature offer abundant proofs that magnesium sulphate is a powerful sedative, which evidence I have never sought to question; in fact, I have published certain observations of the powerful, depressing effect it has upon dogs. However, that the salt has the ability to raise specifically the sedative power of morphine, I do hold to be not proved.

4. The subject of the prediction of synergism treated by me was not touched upon in the reply. This was, of course, not obligatory.

#### SUGGESTIONS FOR THE FURTHER INVESTIGATION OF THE PROBLEM

The various experimental arrangements which might be utilized for study of this subject in the specialized laboratory present themselves so easily to the mind that they need not be reviewed here. It is hoped that some of us in this, or some other laboratory, will have something to contribute toward the further elucidation of the problem in the near future.

As to its clinical investigation along scientific lines I take the liberty of briefly suggesting a plan which I am not in a position to put into operation myself. To wit: a large series of patients to be treated with morphine alone; a similar series with magnesium sulphate alone; a third series with morphine plus magnesium sulphate, neither of the drugs to be used in larger amount than when used alone. If increased sedation is noted in this third series, the effect of the magnesium sulphate to be removed by its antagonist, calcium chloride; persistence of the increased sedation might then be looked upon as evidence of synergism. Work of this nature has been done upon animals by Mansfeld and Hamberger,<sup>4</sup> and I believe that it would be quite feasible to employ the method in the clinic.

#### CONCLUSIONS

I wish only to repeat my conclusions as stated in the last of my papers on this subject:

1. It has been shown in rabbits (Issekutz) and in dogs (this paper) that the alleged synergism of magnesium sulphate and morphine does not take place.

2. No satisfactory evidence has been brought forward to show that this synergism does occur in man.

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638 FOURTH STREET.

## OVARIAN DYSFUNCTION DEPENDENT ON ABNORMALITIES OF THE DUCTLESS GLANDS\*

BY BARTON COOKE HIRST, M.D., PHILADELPHIA, PA.

**I**N CHOOSING a subject for presentation to this Society, I have been influenced by two considerations: first, the problem that perplexes me most in my practice today and secondly, the expectation of receiving more light upon it by the interchange of views and experiences from the members of this body. The dysfunctions of the ovary due to anomalies of endocrine secretion is, I think, as complex, as fascinating a field for investigation, experimentation, and clinical observation as any that medicine presents today. The ultimate solution of this problem, by piecing together bits of information slowly and laboriously obtained, promises relief to a large and increasing number of women as well as relieving physicians from the humiliating sense of futility that has heretofore discouraged us in our efforts to cure such cases.

It is unnecessary to remind such an audience of the pioneer work of Sajous, the investigations of Blair-Bell, the experiments of Stockard, the observations of Papanicolaou, Frank, Allen, Doisy, Zondek, and many others. It suffices to marshall together the facts established at present by many painstaking investigators.

For the normal performance of their cyclical functions, the female sex organs depend on a hormone secreted first by the theca cells of the graafian follicle, of connective tissue origin, and next by the epithelial cells of the granulosa as the theca cells atrophy. It is present in greatest concentration and potency in the developmental stage of corpus luteum growth and entirely absent in its retrograde stage in the nonpregnant female. It is not found anywhere else in the ovary; not in the capsule, nor in the primordial cells or stroma. The same hormone is found in the placenta, whether stored or produced there is not known. This hormone known as the female sex hormone is also produced during pregnancy and is found in parts of the ovary then from which it is absent in nonpregnant females—in atretic follicles and in the corpus luteum in its later development.

The sex hormone is found in the blood stream in varying amounts during the menstrual cycle, most during the premenstrual congestion and least during the menstrual flow (Frank) when, however, it is found in much larger amounts in the menstrual blood than it is ever present in the blood stream. It is also found in the urine.

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\*Read before the Chicago Gynecological Society, March 18, 1927.

The female sex hormone alone of all the endocrine and glandular secretions of the body will induce an estrus in a spayed rodent (mouse or rat); and it will bring about a premature puberty with estrus in immature animals. The hormone of the anterior lobe of the pituitary gland and the decidua vera will also hasten puberty (Aschheim), perhaps in the latter case because it may contain the sex hormone. The secretion from the anterior lobe of the pituitary gland, however, will not establish an estrus in a spayed animal. It does, however, induce an acute congestion of the ovary, if present, and a hyperplasia of theca cells and thus brings about an increased secretion of the sex hormone, but in a spayed animal it has no effect.

Administered by the mouth the sex hormone is positive in its action, but according to Loewe, twenty times the dose is required as contrasted with hypodermic administration. The dose, at least among the rodents, must be proportionate to the weight of the animal. Thus, one mouse unit, the smallest quantity that will produce an estrus in a spayed mouse, is only one-fifth the quantity required for a rat and one-fifteenth that required for a guinea pig. If this proportion holds good for the human female, three thousand mouse units would be needed for hypodermic use and sixty thousand units for administration by the mouth. Loewe, in an investigation of the commercial products in the shape of tablets, could not find in any of them more than a fraction of a mouse unit of the sex hormone, so that any effect on the human system would require the consumption at one dose of several thousand of them! It would seem, however, that this proportion does not hold good for the human female, for Loewe found that 40-100 c.c. of blood from a healthy woman of childbearing age contained one mouse unit of hormone and that therefore the whole blood stream would contain 40-150 mouse units. On the contrary, Bugbee and Simond found that in the rat the dose must be proportionate to the weight.

Curiously enough Loewe found in the blood from the umbilical cord one unit to 15 c.c. of blood, a proportion probably due to the quantity stored or produced in the placenta.

So much may be stated without fear of contradiction. These facts are of the utmost importance to a comprehension of the physiology of sex and of reproduction. They are also of the greatest interest to the clinician, for they suggest possibilities of therapeutics hitherto beyond our reach.

One more statement of fact may be added, though it is ignored by some of the foremost modern investigators who are concentrating their attention on the sex hormone. Stockard and Papanicolaou declare that if an extract from the corpus luteum in its ultimate form is injected in guinea pigs, the estrus is delayed three days, and if the injection is repeated, the sexual function is abrogated altogether.

Seitz and Wintz isolated two antagonistic hormones from the corpus luteum, one a stimulating substance, probably the sex hormone; the other an inhibiting agent, checking the menstrual cycle and the uterine bleeding following its culmination. A commercial firm has on the market tablets which are said to contain these substances. A few clinical experiences of ours would seem to substantiate this claim, especially one case in which a nine months' amenorrhea yielded to treatment only after the stimulating tablet was added to electrical stimulation of the pelvic organs and the injection of the sex hormone; but it is only fair to state that the sex hormone was very weak in units compared with a product which we are now promised after some two years' work in the clinical application of the hormone therapy in collaboration with a commercial firm (Parke, Davis and Company), who supplied us with the material for clinical application while energetically endeavoring to increase its potency.

A word here as to the pharmacologic aspect of the subject: Loewe, in a meeting of the Berlin Gynecological and Obstetrical Society in January, 1926, stated that the best he could do in the preparation of a tablet for ingestion by the mouth was to make it of a strength of ten mouse units. The firm referred to above promises us a product for hypodermic use of twenty-five to thirty-five rat units, perhaps a little more. If Loewe's statement of the blood content of forty to one hundred and fifty mouse units is correct, this preparation would seem to promise results, such as we have never been able to obtain before. To prepare a solution of such potency, it has been necessary to obtain the hormones from the placenta. The preparation from the graafian follicles demanded such a large gland consumption as to be impracticable.

After a brief review of established facts which may be said to be incontrovertible, there is room for speculation in regard to a function of the ovary not demonstrated as yet by scientific laboratory research but suggested by clinical empiricism.

The connective-tissue stroma of the ovary is usually dismissed as having no function whatever, and yet the theca cells of connective-tissue origin undoubtedly secrete the sex hormone. It would not be surprising, therefore, to find the ovarian stroma producing a hormone of physiologic activity. We are all familiar with a peculiar type of inexplicable menorrhagia and metrorrhagia in young nulliparous women and virgins, in which the usual causes can be excluded. There is no syphilis, no hypertension, no abnormality in clotting time, no displacement or other pelvic abnormality, no chronic malaria, no valvular heart defect. Uterine astringents are useless, and curettage has no effect. Some of these cases have been cured in my practice by ovarian residue when everything else has failed. Is it not possible that the cells of the stroma have a restraining effect upon the development



of the endometrium, overstimulated perhaps by an excess of sex hormone, or unchecked by a deficient development in the later stages of corpus luteum formation, a condition found in so-called cystic ovaries in which the graafian follicles never reach their full development and fail to produce a typical corpus luteum?

The main problem that I had in mind for discussion is the agents at our command and choice of treatment in cases of scanty and infrequent menstruation or complete amenorrhea and the accompanying sterility, for which so many patients are consulting us.

The three specific agents at our command that may restore or initiate a normal sex physiology are the sex hormone, electrical stimulation of the pelvic organs, and the stimulating dose of the x-ray.

With the first two I have had experience, but I have much more to learn. With the last I have no personal experience, for I have felt reluctant to recommend it until the radical difference of opinion among roentgenologists is reconciled. I hear from some of them that the x-ray is always destructive to the sex glands, but Stockard's experiments on guinea pigs would seem to refute this statement, and I have been shown some convincing cases and statistics, especially in the Mt. Sinai Hospital in New York, that support Stockard's view. German literature contains many affirmative statements as to the stimulating dose on the ovary of the roentgen rays, and Professor Werner, of Vienna, claims that a stimulating irradiation of the hypophysis may supplant the application of the x-ray to the ovary.

Roentgenologists must settle these conflicting claims among themselves, but it looks as though we gynecologists must in time avail ourselves of this treatment in selected cases. Excluding this agent for the present, there is left to be considered the use of the sex hormone and electrical stimulation.

My experience with sex hormone began twenty-one years ago when, in collaboration with the late Professor Allen Smith, I prepared a glycerin extract from the human corpus luteum and injected it in a few women with some positive results. One remarkable case was that of a patient with acute suppurative salpingitis from whom both tubes and ovaries were removed, according to the record taken in operating room at the conclusion of the operation. This woman returned with the symptoms of the precipitate menopause. She received one hypodermic injection of the corpus luteum extract and was lost sight of until some three months later when she returned pregnant. There must have been a scrap of ovarian tissue left which was stimulated to ovular production by the sex hormone.

These experiments of mine were then intermitted on account of the difficulty of procuring sufficient material to work with. When commercial firms began to put on the market various combinations of endocrine products for mouth administration, I tried them extensively

in many combinations, but with the unsatisfactory results we have all doubtless experienced. Stimulated by Stockard's experiments, I secured from Parke, Davis and Company ampules of the sex hormone, which were also distributed to members of my Staff, Dr. John C. Hirst, 2nd, and Dr. Andrussier. During the past year or more, this preparation has been used in some forty cases. Dr. J. C. Hirst has reported recently to the Philadelphia Obstetrical Society the results in his series, excluding some early cases, as the first ampules contained only one rat unit, and some of the patients failed to appear regularly. The results were in some instances quite striking, in others negative. My own experience was the same. On the whole our results were much like those of Frank, Pratt, Allen, and others. There was nothing comparable with the exact and invariable results secured in mice, rats, guinea pigs, and monkeys. There seems no rational explanation for this fact except the dosage. If Loewe's calculations are correct and if weight alone dictates the dose, women should receive three thousand mouse units or six hundred rat units which, as far as I know, they have never received. Allowing for the fact that this proportion may not be necessary in the human female, the dose heretofore employed has been so minute compared with the woman's weight it is strange that any results at all have been secured. It would appear, therefore, that at least one hundred rat units might be the initial dose, to be increased steadily until something like the invariable effects in the lower animals appear. If we are supplied with ampules containing, as I am assured, twenty-five to thirty-five rat units, such doses become practicable. The best manner of administration must be determined by clinical observation. The convenience of the patient must be considered. It will be difficult to find patients who will submit to several injections a day, as they are given to the rat,—three injections at four hour intervals,—and still more difficult to make them submit to this treatment daily over a considerable space of time. Fortunately this will not be necessary. Loewe, whose study of this subject from the pharmacologic point of view is valuable, points out that the sex hormone is stable in the system; that the effect of the injections appears in mice and rats at the end of seventy-two hours, and that, therefore, the injections in human beings need not be given more frequently than every other day. Consequently, I cannot see why we should not give a single massive dose, increasing, if our experience shows it to be necessary, until the physiologic result is secured. I intend to act on this assumption in the future, and I hope those of this audience who are interested in the subject may try a similar plan, so that a collective investigation will shortly demonstrate whether our expectation of the success of this treatment is justified or not. At present I have four women under treatment with respectively 25, 50, 75 and 100 rat units as the initial dose.

In regard to the electrical stimulation of the pelvic organs, I feel myself on much surer ground. I have employed this agent for more than fifteen years and have secured results in some cases not, I believe, to be obtained in any other way. With the negative pole, in the shape of a metal ball on an insulated handle, resting against the cervix and a large sponge pad on the abdomen, galvanism (about 12 milliamperes), faradism, and the sinusoidal current can be applied. While there is nothing specific about this treatment as a physiotherapy, its value in other regions on ill-developed or atrophic muscles and as a stimulant of circulation, nutrition, and a corrective of apathetic function is universally recognized.

My best results, I must confess, have been in the cases of superinvolution, but they have also been encouraging in primary amenorrhea and lack of development, except in extreme cases that are obviously hopeless. Incidentally this treatment will cure permanently the most obstinate cases of constipation and a hypertension dependent on intestinal toxemia. Some of the results of this treatment have been reported to the American Electro-Therapeutic Association.

Finally, our increasing knowledge of female sex physiology and the utilization of this knowledge in the treatment of its anomalies impresses on us the necessity of a more accurate differential diagnosis. We feel the need of distinguishing between the amenorrhea of an atrophic endometrium in a shrunken or ill-developed uterus with ovaries whose function is normal or simply held in abeyance but not abrogated and ovaries primarily at fault. Other questions suggest themselves, such as the determination of doubtful sex in pseudohermaphrodites.

Clinical laboratories in connection with our large hospitals must be prepared to meet this demand. We should be able to ask for a report of the proportion of sex hormone in the blood, urine, menstrual blood, and the blood of the umbilical cord.

In a retrospect of the past, a survey of the present, and a glimpse into the future, it is evident we are on the threshold of an addition to our therapeutic power equally welcome to ourselves and to our patients.

*(For discussion, see page 121.)*

# RUPTURE OF THE UTERUS IN THE SCAR OF A PREVIOUS CESAREAN SECTION OCCURRING TWICE IN THE SAME PATIENT WITHIN ONE YEAR\*

By MAURICE J. GELPI, M.D., NEW ORLEANS, LA.

ALL acute abdominal emergencies have a certain fascination for the surgeon, but few, if any, furnish a source of greater interest than rupture of the uterus following cesarean section. I have witnessed this catastrophe only three times, but the accident occurred twice in the same patient, which makes the case of sufficient interest to warrant its presentation.

## CASE REPORT

Mrs. F. S., a white woman, aged 27, was admitted to Charity Hospital by ambulance December 25, 1919. At the time of admission she was cold, pale and clammy, her pulse was 140, and she complained of severe abdominal pain. Dr. H. L. Zengel, her attendant, had made a diagnosis of uterine rupture, so that preparations had been made for infusion and for immediate operation, and not a moment of time was lost on her arrival in the institution. Immediate laparotomy, after infusion, revealed a rupture of the uterus in the scar of a previous cesarean operation. This scar was in the fundus and longitudinal, about three and a half inches long, and was ruptured throughout its length. The placenta protruded through the rupture, and the abdominal cavity was filled with free blood and clots. The clots were quickly removed, but no attempt was made to remove the remaining blood and serum. After the removal of a perfectly formed, dead fetus, and the placenta and membranes, the old uterine scar was excised and the uterine wound rapidly sutured. Number two chromic catgut interrupted sutures were first inserted about three-quarters of an inch apart, and these were supplemented by a single continuous suture of number two chromic catgut. (Since that time I have been suturing the uterus after cesarean section in three tiers.) The abdominal wall was closed as usual in layers. No other procedure was considered at the time because of the serious condition of the patient. In about seventy-two hours the primary effects of shock and hemorrhage gradually disappeared, and her recovery was excellent. She was discharged in good condition January 13, 1920.

Her previous history, which was secured after operation, revealed the fact that she had been married six years and had had her first child normally at term five years before admission. Two and a half years later a second child was delivered at seven months by cesarean section, by Dr. A. O. Hoefeld, the indication apparently being placenta previa. The child, though premature, was normal, and lived. The mother, however, "broke her stitches," to quote her own description, and had to be resutured. The third pregnancy was quite normal until Christmas day, 1919, the day of her admission to the hospital, when, after she had carried her child for five squares, straddling her abdomen, she was suddenly seized with violent, acute abdominal pain, followed by air hunger, thirst and weakness. It was at this stage that Dr. Zengel saw the patient, diagnosed her condition, and sent her into the hospital, with the results already described.

\*Read at a meeting of the New Orleans Gynecological and Obstetrical Society, April 7, 1927.

On December 16, 1920, less than a year after the first rupture, I was informed by telephone that this same patient, then some seven months pregnant, had developed precisely the same symptoms as she had previously experienced. She was immediately brought to the hospital in the ambulance, and physical examination revealed exactly the same findings and symptoms as on her first admission, though her pulse was only 120 and her general condition was not so critical. Immediate laparotomy disclosed a rent about a half inch wide between the edges of the second cesarean scar. The whole scar was thinned out and very much attenuated, so much so that when later the uterine wall was held up to the light, it was actually translucent. The peritoneum still covered most of the rupture, so that the membranes were found intact. The placenta was situated posteriorly, and was not in contact with the scar at any point. A Porro operation was done, a normal, living child was extracted, and both mother and baby made an uneventful recovery.

I have recently been informed that mother and child are both living and well, and, *mirabile dictu*, exceedingly grateful.

(For discussion, see page 118.)

CHAILLE BUILDING.

## HERNIA FUNICULI UMBILICALIS, WITH REPORT OF THREE CASES\*

BY A. F. HEBERT, M.D., NEW ORLEANS, LA.

IT HAS been my good fortune during the past ten years to have under my observation three cases of congenital hernia of the cord, and after careful search of the literature, French, German, Italian and Spanish, as well as English, I have found but one physician who had treated a larger number, namely, four.

W. S. MacDonald reviewed the literature up to 1890 and found eighteen cases which had been operated upon, with sixteen recoveries and two deaths. These, however, were all of the small variety, with the intestines the only contents of the sac. He found twelve cases which had been treated expectantly, with three recoveries and nine deaths. He himself had had one case under his observation, which he had operated upon six hours after birth, the contents of the hernia being the ileum, ascending colon, cecum and appendix.

Samuel C. Benedict in 1892 reported one case in a ten-pound child, with the liver, spleen and bowels in the hernial sac. Operation was done fifty-three hours after birth, but the results are not stated.

G. C. Stewart in 1904 reported one case in an otherwise normal male child, the hernia being the size of an apple, and containing the liver and bowels. Operation was done fifteen days later by Dr. Griffith.

George W. Cutler in 1919 reported three cases, one of which he operated upon twenty-four hours after birth.

Frederick G. Dyas in 1920 reported one case operated upon eight hours after birth. The contents of the sac were only the intestines. The child lived two days and died of congenital atresia of the bowels.

Edgar G. Mathis reported two cases. The first, one of twins, was a normal sized male child, who was operated upon forty hours after birth. The sac contained about

\*Read at a meeting of the New Orleans Gynecological and Obstetrical Society, April 7, 1927.

half of the liver, and death ensued in eighteen hours. The second was a seven-pound male child, who recovered through expectant treatment. The sac contained only intestines, and after the cord dropped, granulation took place over the hernial opening.

Ricardo Carnelli, Director of the Civil Hospital of Modeliana of North Italy, reported the case of a girl, delivered normally and operated upon five hours after birth, who lived five days. The liver and intestines were in the sac.

Frederick C. Pybus reported one case in which the hernia was the size of a chicken egg and extrophy of the bladder was present. Operation was done six hours after birth, and death ensued in seven days.

D. T. Cannon reported a case operated upon six hours after birth, in which the tumor was the size of a large pear. The child lived six months and died eventually of marasmus, largely through parental carelessness.

H. Fowerlin and D. P. Bade reported the case of a healthy female weighing nine pounds, with a hernia the size of a chicken egg. Operation was done nine hours after birth, the sac containing two loops of bowel together with the cecum. Chloroform was administered for an hour.

Reifferscheid of the Woman's Clinic at Göttingen reported the case of a four and a half pound child, operated upon eight hours after birth. The hernia was quite large and contained the liver and intestines. The wound did not close for twenty-five days and the child was finally discharged with a large postoperative hernia.

Unfortunately, the various case reports are not all given in detail, and comparison of the conditions found, the procedures and the results is obviously impossible.

Malgaigne was the first to study these deformities, and to emphasize the fact that they were not true herniae, since the viscera had never entered the abdominal cavity. Ruysch in 1691 called attention also to the fact that the umbilicus is not developed in these cases. Different opinions are held as to the etiology. Cruveilhier believes the cause to be pressure in the abdomen of the fetus due to faulty position. Scarpa considers it to be traction on the cord, because of winding about the fetal body. Ahlfred considers it to be constant pulling of the vitelline duct on the intestines in the root of the umbilical cord. St. Hilaire believes that accidental bands of adhesions hold the viscera out of the abdomen.

The condition is quite infrequent. In the last 8,410 obstetric cases handled at Touro Infirmary there were but two instances; one child was operated upon with recovery, the other died shortly after birth. There was no report of such a condition in the last 10,995 cases at Charity Hospital. At the Long Island College Hospital two instances are reported in 7,200 deliveries; one of these was so extensive that operation could not be considered; the other child was operated upon, but died in twenty-four hours. Sixteen cases are reported in 29,780 deliveries at the New York Lying-In Hospital. One of these was operated upon and death followed in a few hours. Watson states the frequency of congenital umbilical hernia to be about one in ten thousand, and the collected statistics would probably bear him out.

The diagnosis is usually evident. A tumor mass is apparent on the abdomen immediately after delivery, the size depending upon the contents, and the only other conditions to be considered are hydrocele

of the umbilical cord and urinary diverticulum. In the smaller hernias strapping gives good results, but surgery is the only possible treatment in the graver types.

#### CASE REPORTS

CASE 1.—Baby K., born April 18, 1918, male, eight pounds, six ounces, normally delivered of a multiparous mother. A mass about the size of a small orange was apparent at the umbilicus, covered with amnion, Wharton jelly and peritoneum, with coils of intestines definitely palpable. Several attempts at reduction were made, but it was obvious that the intestines could not thus be restrained. About forty-five minutes after birth operation was done by Dr. William Kohlman under ether anesthesia. An incision was made through the amnion, Wharton jelly and peritoneum, opening into the cavity, and revealing the presence outside the cavity of a loop of small bowel with the cecum and appendix. No adhesions were present. The amnion and peritoneum were cut at the edge of the skin, and closure was done in tiers. The recovery was uneventful.

CASE 2.—Baby H., born November 22, 1923, of a primiparous mother; weight six pounds. Forty-five minutes after birth, when I first saw the child, a dark colored, oblong mass, about three by two inches, was present at the umbilicus. Under ether anesthesia an incision was made through the amnion, Wharton jelly and peritoneum, the peritoneum being separated from the bowel with some difficulty because adhesions had already formed. The bowel was quite dark, and there was a plastic exudate between the coils. The condition was obviously hopeless, since gangrene had already set in, and the amount of bowel involved made resection an impossible procedure. The contents of the sac were rapidly reduced and closure done in tiers. The child lived about fifteen hours.

CASE 3.—Baby J, born July 21, 1926. The child was premature, weighing but five pounds, and I saw her within ten minutes after birth. A large mass, the size of an orange, was present over the anterior surface of the abdomen, extending from the xyphoid process downwards. The upper half of the mass was quite dark and hard, the lower part was soft, and palpation showed it to contain bowel. About twenty minutes after birth operation was done. Under ether anesthesia an incision was made from the xyphoid process to the lower border of the mass, through the amnion, Wharton jelly and peritoneum. At first the knife encountered a hard substance, which proved to be the liver. In the course of separating it from the peritoneum, another obstruction was met, the falciform ligament, and with the scissors this band was cut to the edge of the skin. After the liver had been completely separated from the sac, it was found to be torn in two places, repair being done with U sutures. When the liver was thus freed and the bowel was ready to be replaced in the abdomen, the amnion and peritoneum were cut at the edge of the skin, leaving an opening in the interior abdominal wall about four inches long and two and a half inches wide. Closure was done in tiers, using chromic catgut number one for the peritoneum and fascia, and plain double 0 for the skin. Twice during the operation the child stopped breathing, and was revived by artificial respiration. For three days it vomited everything given it, and finally, as a last resort, it was permitted to nurse at the breast. From that time recovery was uneventful, and it is now a normal, healthy baby, having been examined last on July 21, 1927.

*(For discussion, see page 116.)*

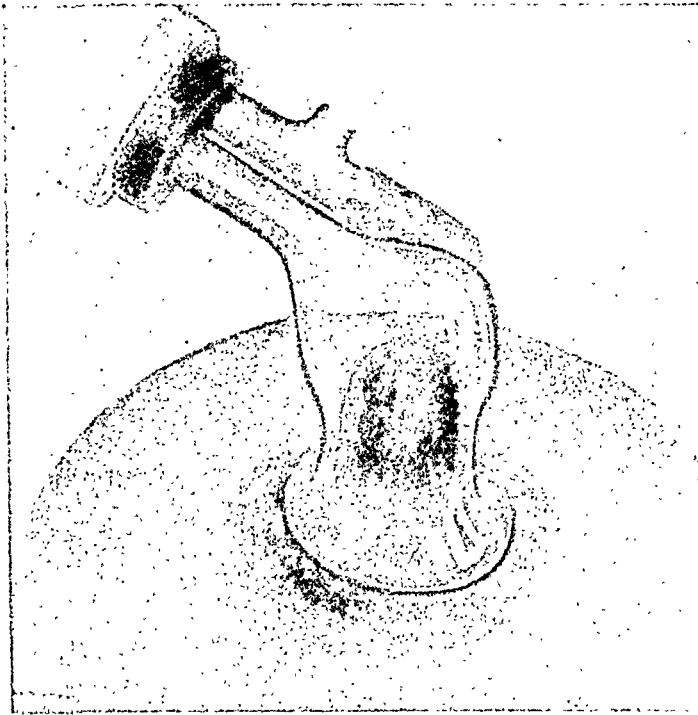
# A NEW STYLE FUNNEL FOR USE WITH THE ELECTRIC OR KIETH WATER POWER BREAST PUMP

By F. P. McNALLEY, M.D., F.A.C.S., St. Louis, Mo.

*(From the Department of Obstetrics of Washington University School of Medicine  
and Barnes Hospital)*

THE electric and water power (Kieth) breast pumps for use in the hospital and home have provided us with, by far, the most satisfactory means of emptying the nursing breast devised up to the present time. Their short-comings lie only in the funnel. The chief difficulty with the funnel supplied with the Abt pump is that the nipple is drawn down into the stem of the funnel and occludes the ducts. This happens immediately in the small flabby breast, and in most breasts after the pump has been used for a while. Kieth has corrected this defect to a certain extent by enlarging the small end of the funnel just before it reaches the stem. However, there are many nipples that are sucked past this enlargement into the stem.

Another difficulty noted only in the firm, hemispheric breast is that instead of being pulled too far into the funnel, it is only pulled in part way and the portion at the level of, or just above, the areola is compressed, shutting off the ducts and stopping the flow of milk.



In an attempt to overcome these difficulties, various sizes and shapes of tapered funnels were tried, without success. Finally, it seemed reasonable that since nursing by the baby was entirely on the nipple, any attempt to imitate the maternal process should be devoted to this area. With this in mind the present funnel was designed, and after considerable use seems to be an improvement over the other types. Up to the present time it has pumped all breasts satisfactorily. Its advantages are that its use is more comfortable to the patient, and that it empties the breast faster and more completely.

The Henry Heil Chemical Company of St. Louis has had some made of ordinary glass which are now in use. If the breakage is too great, pyrex glass will be substituted.

I wish to express my appreciation to Mr. Varney of the Department of Bacteriology, for his cooperation in making many of the experimental funnels.



# Society Transactions

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## AMERICAN GYNECOLOGICAL SOCIETY

### FIFTY-SECOND ANNUAL MEETING

HOT SPRINGS, VA., MAY 23, 24 and 25, 1927

*(Concluded from the December issue.)*

DR. W. C. DANFORTH, Evanston, Ill., and Dr. B. C. CORBUS, Chicago, Ill. (by invitation), presented a paper entitled **Pyelitis in Pregnancy**. (For original article see October, 1927, issue, page 544.)

### DISCUSSION

DR. L. A. CALKINS, UNIVERSITY, VA.—Pyelitis during pregnancy is a very important problem with us. We have diagnosed pyelitis 32 times in the last 650 pregnancies coming into our clinic, making an incidence of about 5 per cent. Fourteen of these presented clinical symptoms during pregnancy, and 18 in the first few days after delivery; the postpartum cases usually showed symptoms within twenty-four to seventy-two hours after delivery. The fact that so many patients with pyelitis after delivery improve after they are placed in a recumbent position, and that those who have symptoms previous to labor improve so markedly and so promptly after delivery, is very suggestive. That there is something more than pregnancy seems beyond reasonable doubt. The only suggestion that I have to offer is that possibly a patient may not have pathologic alterations in her upper urinary tract, but that the normal anatomic constrictions of the ureter (usually the lower two of the three, the one at the pelvic brim or the one at the ureteral bladder junction) may be affected by the pregnancy with its normal pelvic congestion, involving all the organs in the pelvis, and thereby become sufficiently tight to produce obstruction in the upper urinary tract and bring about a possible infection.

It was interesting to note that of our 14 cases presenting clinical symptoms during pregnancy, 12 required local treatment of the type referred to by Dr. Danforth; whereas of the 18 showing clinical symptoms after delivery only one required local treatment. The other 17 responded to the general measures usually employed.

DR. ALFRED C. BECK, BROOKLYN, N. Y.—Our pregnant patients with pyelitis divide themselves into two groups. In the one, the patient appears in our clinic within a day or two after the onset of symptoms. Rest in bed, the Trendelenburg posture, requiring the patient to lie on the left side, forced fluids and alkalis, as a rule, result in prompt relief of the symptoms. We do not find any pathologic changes later in these cases. The patients that come to us, however, after the symptoms have existed for some time do not all respond to this treatment. Some of them require catheterization, and in our clinic we prefer to resort to drainage by catheter rather than lavage.

DR. J. HOFBAUER, BALTIMORE, MD.—I desire to present to the Society a brief report of the work done in the Obstetrical Department of the Johns Hopkins University on the subject of pyelitis in pregnancy, and to illustrate our findings by a number of lantern slides.

The present correlated study is an attempt to answer the following questions:

1. Why does the ureter undergo dilatation so frequently in pregnant women, and can the etiologic factor be established as a demonstrable obstruction in the urinary tract?

2. Is an association of bacteriuria with urinary stasis sufficient to produce an inflammation of the renal pelvis, or must some additional predisposing factor be considered, such as a lowering of local or general tissue resistance?

3. Does the infection of the ureter and the renal pelvis interfere with the process of restoration of the anatomy and function of these organs to the status *quo ante*?

4. Can certain new ideas be derived from this study with regard to the proper treatment of the condition?

The results of our investigations clearly show that the pelvic portion of the ureter during pregnancy undergoes a definite hypertrophy, and that this hypertrophy is most marked in the intramural and juxtavesical portion, while in the abdominal portion of the ureter, only a slight increase of the fibers is noticeable. Histologic examination bears out the point that both the muscle bundle and the connective tissue participate in the hypertrophy of the pelvic ureter, and particularly that the connective tissue, due to the abundant formation of new fibers, assumes a rather dense appearance. The ureteral wall as a whole presents a rather compact structure. In the juxtavesical portion of the ureter, in addition to the structural changes just mentioned, a very considerable hypertrophy of the ureteral sheath can be seen. In addition to these factors which result in a narrowing of the ureteral lumen, a more or less pronounced congestion of the mucosa may further narrow the lumen. In the area of the trigonum, a marked hypertrophy of its constituents,—muscle, connective tissue, and elastic fibers,—is a characteristic feature. This hypertrophy accounts for the clinical phenomenon that on cystoscopic examination the trigonum as a whole and the interureteral ridge in particular, appear more elevated and protuberant than in the nonpregnant woman. And for our present consideration this fact is of special interest, since of late such changes in the trigonum have been recognized as an essential factor in producing both a shallow cavity behind the interureteral ridge and a pronounced urinary obstruction. This factor affords an explanation for the frequent occurrence in pregnant women of the retention of several ounces of residual urine, an observation made first by A. C. Curtis.

Asymptomatic bacteriuria is not uncommon during pregnancy. The bacteria are excreted from the blood stream through the kidneys and the liver. The possibility of an ascending infection, however, may be considered in certain cases when the intravesical portion of the ureter has undergone to a high degree the structural changes outlined above, and the ureter has become converted from a collapsible into a rigid tube with a subsequent alteration of its valve-like arrangement in the ureteral orifices, as is sometimes seen on direct cystoscopic examination.

To set up inflammation in the renal pelvis, the local resistance of the tissues must be lowered or the general resistance of the organism must reach a low level. It can be shown that within the connective tissue of the renal pelvis there develops in pregnant women, in response to increased intrapelvic pressure, an accumulation of highly phagocytic cells—quite similar to the defense mechanism in the parametrium during labor. Pelvic overdistension spreads open this barrier, and the pelvic contents pass through these breaches into the venous capillary network of the calices,—“pyelovenous backflow,”—followed by the clinical symptoms of an acute attack. The study of the opsonic index in fifty normal women in various months of pregnancy showed that in about 10 per cent there could be demonstrated a marked lowering, as proved against three different strains of *Bacterium coli*. This observation tallies with the statement made by Koessler several years ago that during pregnancy there occurs a marked lowering of the opsonic index of the blood toward the tubercle bacillus.

Twenty-seven cases of pyelitis,—nine in which pyelitis developed during the puerperum,—were studied from four weeks to two years after the termination of pregnancy. Pyelograms showed considerable dilatation of the ureter in nine cases. Persistence of *Bacillus coli* in the urine obtained by ureteral catheterization, was found in seven out of fifteen cases, in which the organism was obtained at the time of the attack of pyelitis; persistent albuminuria and a large number of pus cells were found in two cases respectively.

One must conclude from these findings that termination of pregnancy merely renders the patient asymptomatic. With the subsidence of the classical symptoms, our treatment is not at its end,—indeed the real treatment must now begin.

If we succeed in conveying a clear conception of the etiologic factors operative in pyelitis of pregnancy, the course to adopt, in addition to the current treatment, is to restore, if possible, the efficiency of the atonic ureter; to increase the bactericidal power of the blood and the tissues, to limit the absorption of bacteria by changing the intestinal flora.

The administration of repeated small doses of pituitary extract answers several purposes: It increases both the tone and the automatic contractions of the ureter. It stimulates the elaboration of antibodies, particularly, when combined with infusions of a hypertonic glucose-solution, it exhibits a specific antiphlogistic action, and relieves ureteral congestion.

Lactose is known as the most effective carbohydrate in checking intestinal putrefaction. Calcium lactate has a similar effect. On account of the possibility of renal involvement no antiseptic drug should be used in the treatment of pyelitis in pregnancy.

DR. REUBEN PETERSON, ANN ARBOR, MICH.—In twenty-two cases of pyelitis in pregnancy hastily gathered together for this meeting, I find that there was very little preceding genitourinary disturbance. In fact, there were only two that gave a history of previous pyelitis, although in two the histories were doubtful. The symptoms began about the fifth or sixth month of pregnancy. Whether this is due to pressure of the uterus on the ureters or whether it is due to other causes as has just been brought out in the paper, I do not know. In one case, symptoms started at three months, although here there was a previous history of pyelitis. In ten of the patients, cystoscopy was practiced, and the passage of renal catheters showed pus from both ureters. In two the renal pelves were dilated. In one case there was marked dilatation of the ureters as shown by x-ray. Not all cases were examined bacteriologically. In seven, however, the pyelitis was shown to be due to the *Bacillus coli*.

I am convinced that it is just as much our duty to follow up these patients with pyelitis in pregnancy after they leave the hospital as it is to follow up the patients who have been treated for cancer, because a certain number of patients are proved to have a residuum of trouble in the kidneys and ureters.

In corroboration of Dr. Hofbauer's report that pituitary extract is valuable in the treatment of pyelitis, I may say that recently in one of my ureteral transplant cases there was no flow of urine from the rectum in thirty-six hours. I became quite alarmed for fear I had constricted the ureter and gave a dose of pituitrin with the result that the urine immediately appeared in the rectum.

DR. DANFORTH (closing).—I agree with Dr. Beck about importance of the catheter merely as a means of drainage. We have tried lavage of the kidney, with antiseptics and without, and are in favor of depending on the use of the catheter. We insure the permeability of the catheter by passing some salt solution through it at first and also afterward, if it becomes plugged.

Dr. Hofbauer's demonstration quite probably explains why so frequently we found obstruction at the vesical ostium of the urethra. In most of our cases we

had obstruction at that point, and we shall be glad to try out his suggestion of the use of pituitrin.

Replying to Dr. Nicholson's question we practically always leave the catheter in from 24 to 36 hours, although frequently we leave it longer than that if the patient is seriously sick. We rarely have had a resort to artificial abortion.

DR. JOHN OSBORN POLAK, Brooklyn, N. Y., presented a paper entitled **Study of the Effects of Blood Transfusions on Obstetric and Gynecologic Conditions.** (For original article see October, 1927, issue, page 537.)

#### DISCUSSION

DR. GEORGE GRAY WARD, NEW YORK CITY.—In October, 1924, I advocated this procedure as a prophylactic measure, after an experience at the Woman's Hospital of some two years, using it to build up the patient prior to operation rather than as a last resort measure. At the Woman's Hospital, we have used the Unger method and the Scannel apparatus. We stress the importance of bringing the gynecologic patient to operation with sufficient blood to go through the ordeal, especially as among gynecologic patients many have been subject to hemorrhages which have reduced their resistance, especially in fibroids. Also in some of the plastic cases we did not realize the extent of the oozing, and with a low red blood count, the additional 200 or 300 c.c. of blood lost is sufficient to make a very marked difference in convalescence, often prolonging it considerably.

We have also found that it is a very valuable procedure in fortifying our cancer cases. When we use radium, we make a practice of transfusing the patient if possible, and we feel that the patient is distinctly benefited by being better able to combat the toxic condition and in making a very much better recovery from the irradiation.

The average amount of blood used in these transfusions was about 500 c.c., which is easy to get. It is harder perhaps to get 1000 c.c. as that amount will more or less weaken the donor.

In giving transfusions it is necessary that the interne should be properly trained to do this because, while we may count on the laboratory to make the typing, etc., we often need this on a Sunday or holiday when the laboratory technicians are not there, so we have our interne trained to type and match the blood, requiring him to pass a practical examination by the pathologist before being allowed to do this alone.

In 1924 I reported 282 cases, 50 per cent of which were prophylactic cases. Since that time, in a second series, we reported 291 cases, of which 263 or 90 per cent were prophylactic, and 28 or 10 per cent were emergencies, making a grand total of 573 cases.

I wish to sound a word of caution as to the danger of internes doing this as a routine procedure. Accidents have occurred by our not appreciating fully the dangers that exist. We had two sudden deaths, and soon afterward two cases of collapse in private patients after only 200 c.c. of blood had been given, though these patients recovered quickly. We then began to look into the matter and found that there had been some carelessness in technic or selection of case. The danger is that the patient's heart may not stand transfusion in these depleted cases, and cardiac dilatation may occur. We believe that it is not wise to transfuse while the patient is under an anesthetic, for one cannot tell what the reaction is, and we avoid that except in emergencies.

DR. JOSEPH L. BAER, CHICAGO, ILL.—Recently a new classification for grouping has appeared, the so-called agglutinin classification which depends upon the

fact that the patient has either no agglutinin substances, or one of two such substances, or both kinds. Then the zero group contains none and is the universal donor. The *A* group contains one. The *B* group contains another and the *A-B* contains both. Zero can give to anybody; *A* can give to *A* or *A-B*; *B* can give to *B* or *A-B*, and *A-B* can give only to *A-B*.

At the Michael Reese Hospital maternity transfusions were limited to infants for many years. The surgical department has been developing a greater frequency of blood transfusions. The hospital has a very considerable group of donors. There are fifty medical students on call all the time. Each of them is given the Wassermann test every six weeks. Each one is known in his proper classification. The checking is done immediately before the transfusion. It is much better to give a small transfusion, wait a few hours and give another small one preoperative than to give one large transfusion. If a second transfusion is given of the same group from which the first donor came, it is nevertheless necessary to check again with the second apparently identical group donor, because McQuarry and Hopkins showed in 1923 that there are subgroups, and there may be disaster unless each successive donor is checked regardless of the fact that he is in the same group.

DR. FRANK W. LYNCH, SAN FRANCISCO, CAL.—We first used blood transfusions for replacement in preparation for operation, and secondly as a stimulation for the marrow cells to increase the output. We then gave it chiefly to patients with hemorrhage, viz., fibroids, essential menorrhagia, and uterine cancers. But as we have developed transfusions and given them in pregnancy for pernicious vomiting and other toxemias and to postoperative patients who were not doing well but who had no evidence of infection, we came to appreciate that the chief value of blood was that of the most assimilable and lasting of all foods.

Our cases are not quite like those of pernicious anemia where the marrow cells are making as much blood as possible and cannot be stimulated to greater productivity. Our cases are acute conditions rather than chronic. The toxemias, postoperative cases, and cancers have their own problem, and we use the blood chiefly as food and in lesser measure to stimulate the hematopoietic cells which may not be acting to full capacity. We have come to believe also that blood given by transfusion does not aid healing nearly as much as if the patient made it herself. Thus, if we take a patient with low hemoglobin, 18 to 20 per cent, and build her up to approximately 50 per cent hemoglobin and 3,500,000 red blood cells, it does not follow that her power to withstand infection is as great as if she had developed for herself the same blood count. We have learned from experience that, when treating a gynecologic patient with less than 20 per cent hemoglobin but who needs much operative work, it is well to build her up by transfusion to at least 50 per cent hemoglobin, and then do as little surgery as seems imperative and not forget that in such cases the blood as ordinarily given has little more than food value.

For these reasons we are not insistent that the staff transfuse only whole blood except in the presence of infections. Citrated blood has its value. We are more interested in having the patient get the blood for food than in the method of transfusion.

DR. J. HOFBAUER, BALTIMORE, MD.—I desire to present a brief report of the work done in the Johns Hopkins Hospital on the subject under consideration.

The importance of blood transfusion as an early treatment in severe cases of premature separation of the normally implanted placenta was emphasized last year in our studies on histamine intoxication. In view of the great reduction of blood volume in actually effective circulation, transfusion in this condition serves the purpose of restoring the deficient blood volume. (See AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, vol. xii.)

With regard to the effect of blood transfusion in cases of puerperal infection, the available evidence supports the view that in all probability we have to deal here with the action of foreign protein therapy on the reticuloendothelial system. However, it is still a matter of controversy whether transfusion may actually confer on the organism a higher resistance in acute or more protracted cases of infection.

The researches of recent years have added considerably to our knowledge of the function of both the endothelium and the reticuloendothelium system as organs of defense and elaboration of antibodies, and evidence has been accumulating to show that local immunity may be essentially due to a demonstrable activity of phagocytic cells. On the basis of this evidence investigations have been carried out in the obstetric department of the Johns Hopkins Hospital to search for such therapeutic agents as would elicit evident reactions on the reticuloendothelial apparatus and by so doing would potentiate the therapeutic effect of blood transfusion. Stimulated by some advances in our knowledge of hormone activities on one hand and the effect of hypertonic solutions on the other, for purposes of studying this question, pituitary extract and hypertonic solutions of glucose were chosen. Our investigations were conducted first on normal puerperal women from the third to the fifth day of the puerperium, with a view of ascertaining, if possible, the influence of these substances on the bone marrow and the spleen.

As an invariable result in these experiments the following phenomena could be recorded: There occurred a marked increase in small lymphocytes and monocytes. Myelocytes and transitional cells made their appearance. In most cases a definite increase of platelets could be seen. The leucopenia as an immediate result of the infection was followed by a moderate leucocytosis. A considerable increase in the red blood count was observed after the administration of 25 per cent glucose.

It was an essential feature of our observations that an enhanced reaction could be seen whenever the injection of pituitrin (0.5 c.c. each dose) was combined with a subsequent infusion of 500 c.c. of 10-15 per cent glucose, or 150 c.c. of a 25 per cent solution.

The data given serve to illustrate the fact that the injection of pituitary extract in puerperal women exerts a stimulating influence on the bone marrow, as evidenced by the outpouring in the puerperal blood of both early elements and such cells as are known to increase the resistance of the organism when infected. And the considerable increase in the number of platelets points to a temporary blocking of the reticuloendothelial system by the injection of pituitrin.

The bearing of these observations on the treatment of puerperal infection is worthy of consideration, particularly when it is recalled that a comparatively small increase in the salt concentration of blood has been found to have a considerable influence on the bactericidal power of the blood.

In view of these results, the injection of pituitary extract fifteen to twenty-five minutes prior to blood transfusion is now being routinely employed in cases of puerperal infection. The results obtained seemed to warrant the conclusion that by this combination transfusion is brought to its height of functional activity and better clinical results can be secured. In due intervals hypertonic glucose solution is given intravenously (1) as a protective agent against fatty infiltration of the parenchyma, and (2) as a stimulant of phagocytic tissue elements. Our clinical observations seem to indicate that infusion of glucose should be considered particularly whenever there can be seen a tendency toward a localization of the infectious process. It is hoped that further work may be profitable in this direction.

DR. JAMES R. GOODALL, MONTREAL, CANADA.—Altogether we have transfused twenty-two cases of puerperal sepsis, and my experience has been that in only two cases was there any advantage to be derived from this procedure. In the other

twenty there were eighteen cases in which a very severe reaction occurred, so severe in five of them that the patient was practically moribund within one-half hour. In view of this we have proceeded with very great caution in the matter of transfusion in the cases of sepsis.

In the last three cases of severe puerperal sepsis which have come under my observation, every donor, professional and voluntary, proved unsatisfactory. The doctor who has to do with the grouping in the hospital and who does nothing but that told me that there was not one donor that would quite agree, and I feared to do the transfusion lest the reaction would be too severe. Those three patients all got well, and this leads to the question whether the recovery is always due to the transfusion. We all know that in severe cases of streptococcus infection recovery sometimes takes place by crisis, just as in pneumonia. In view of the fact that there were only two cases out of the twenty-two benefited, it would be hard to draw any conclusion as to the efficacy of transfusion. We have come to the point—and I think I can speak for some of my confreres—where we hesitate to transfuse in puerperal sepsis, and I believe that any advantage that may accrue from the transfusion may be attributed to action other than the resultant of the transfusion.

DR. FREDERICK J. TAUSSIG, St. Louis, Mo.—I should like to report briefly on the work at the Washington University Medical School, largely done by Dr. W. J. Dieckman. We have done in the past four years 227 transfusions on 106 patients, using the syringe cannula method in 10 cases and the citrate method in 217. A new citrate method, which was suggested by Dr. Dieckman, has been used in 177 cases, and the reactions as a result of this improvement in our technic have fallen from 45 per cent by the old citrate method to 14 per cent by the new citrate method. Dr. Dieckman himself has done 30 without any reaction, so I believe with the proper apparatus and technic, this new citrate method can be used without danger.

The amount of blood given has averaged 560 c.c. in volume and the largest amount of blood given was 850 c.c. The largest number of transfusions to a patient was 11.

The particular point that I wish to stress is the results in repeated transfusions at short intervals. I think the mistake we have made in the past has been to give transfusions at intervals of from five to seven days instead of watching the blood picture, the viscosity of the blood and the hemoglobin, and insisting upon giving a transfusion every second or third day until the blood picture has risen to the proper amount. If we do this, we can, according to our experience, shorten the stay of the patient in the hospital very materially.

DR. GEORGE W. KOSMAK, New York City.—In this discussion on the pre-operative preparation of the patient I think we should bear another procedure in mind, especially in fibroid cases that are more or less advanced, in whom we find a myocarditis present. In these cases a proper preoperative digitalization of the patient should not be neglected.

DR. C. H. DAVIS, Milwaukee, Wis.—In some recent experimental work, at Columbia Hospital, Yates and Raine have shown that thirty minutes of gas-oxygen anesthesia without an operation will reduce the oxygen-carrying power of the blood from 10 to 20 per cent. Five hundred c.c. of whole blood after an operation will bring the oxygen-carrying power of blood back to normal. This shows that a transfusion does more than supply fluid and food. Possibly one of the chief values of whole blood transfusion is to boost the oxygen-carrying power.

Regarding the method of transfusion, we have under way at Columbia Hospital a check-up on some 500 transfusions to find out the percentage of reactions with

each method. The indications are that the paraffin tube method gives less reaction than the syringe, and much better results than are obtained with citrated blood. We believe that the citrate method should be discarded and that whenever possible the paraffin tube method used.

In some of the critical cases the bad results may be due to a foreign protein reaction. In one of our patients it was necessary to make skin tests with five donors before a suitable one could be found, although their bloods apparently matched perfectly.

DR. LILIAN K. P. FARRAR, NEW YORK CITY.—I kept a record of the first 300 blood transfusions given by the internes in the Woman's Hospital, and found the percentage of reactions that each interne had. As the laboratory was then typing and matching all blood, and the internes were using the same blood transfusion apparatus, it seemed there should not be much difference in their percentages, but I found the percentages varied from 0 per cent with a few internes to 75 and 80 per cent with two other internes. The majority of the internes had percentages of approximately 8 to 10 per cent, and the total average for all the transfusions given was 25 per cent. The reaction seemed to occur when a very fine needle had been used, so that the blood platelets were crushed, and also when the syringe used was jerked or pushed roughly if the plunger was bound.

Another point is that we do not always consider the amount of blood to be given relative to the weight of the patient or relative to the immediate need of the recipient. A patient of two hundred pounds weight is quite a different proposition from one who weighs only one hundred pounds, and a patient who has just had a severe hemorrhage can receive more blood without having a reaction than a patient who has had a secondary anemia for some time.

Dr. Ward cautioned against giving transfusions while the patient was under an anesthetic, except in an emergency. The reason for this is that a patient will often complain of a feeling of distress a minute or so before dangerous symptoms are noted by the person making the transfusion. That minute may mean the saving of the patient's life. Hypodermics, preferably of adrenalin solution, should be ready for possible severe reactions, to be given either intramuscularly or by intravenous injection or even into the heart muscle, if the patient is in collapse.

The blood transfusion apparatus that we have found most satisfactory in the Woman's Hospital is the Scannell, owing to its simplicity. It is a one-man syringe, requiring no assistant, and consequently there is less liability for error.

DR. WILLIAM R. NICHOLSON, PHILADELPHIA, PA.—I simply want to accentuate, from a bitter experience, the statement made by Dr. Ward and Dr. Farrar that no patient should receive transfusion under anesthesia. We had a case of placenta previa that I was told needed a cesarean section, and I found it needed simply a rapid version. The woman was in very good condition when I finished, but the transfusion being ready, I allowed it to be given before she was entirely out of ether, and she died within two hours.

DR. POLAK (closing).—In regard to Dr. King's question I would say that we have our senior class and the internes grouped and tested with the Wassermann test. These are checked up, and we get our donors from those sources. We feel the responsibility very definitely.

Regarding Dr. Piper's question, I want to clear up one point. The temperature in sepsis has a rise and a fall as a rule. We do not transfuse at the peak, but during the remission which occurs usually in the morning or some time during the day. The temperature goes up at night to 104° F., in the morning it is 101°. We would transfuse at 101° and not wait for it to go up again.



Whether the patient I spoke of who was in the hospital one hundred and two days would have recovered without transfusion, I do not know, but I do not believe she would.

Both of these cases show the importance of time, which is a very essential element, and food, and possibly stimulation of the marrow cells. As to the matching, I have a patient of Group 4 who was matched with 12 donors. All during her sepsis we never succeeded in getting one donor that would match with her. It was interesting that three of these donors who had been refused matched as soon as she came down to normal. This shows the importance of matching immediately before transfusion.

We feel with Dr. Taussig that transfusions should be repeated. We do not wait for the patient to become sick; when she has a rise of temperature and the temperature is not down within twenty-four hours, we repeat the transfusions every third day, giving the small amounts of 200 to 250 c.c.

I learned about three years ago from one of my surgical colleagues the effect of anesthesia on blood, and it was very typical of what Dr. Davis has called attention to, so we never transfuse during anesthesia nor until the anesthesia has worn off. We try to do our work under local anesthesia in the severe cases, such as our ectopics, in order to avoid the effect that it has on the oxygen-carrying power of the blood.

One other point: Preoperative cases where there are any infections, as for instance the pus tube case with exacerbations and reinfections, are poor surgical risks. Or in the parametrial cases it is surprising how boosting these patients along with transfusions and pituitrin has improved their general well-being.

DR. EDWARD C. LYON, JR., New York City (by invitation), presented a paper entitled **The Study of Stillbirths Occurring in 4000 Consecutive Confinements**. (For original article see October, 1927, issue, page 548.)

#### DISCUSSION

DR. HARVEY B. MATTHEWS, BROOKLYN, N. Y.—I should like to stress the definition of stillbirths. Most reports have included infant mortality. We should regard stillbirths as those that occur at or beyond the twenty-eight week only and should not be held responsible for the life of the child before the period of viability. In New York City one must report every abortion or miscarriage as a stillbirth, and I have always been very much opposed to such a scheme because it does not give a true index of the incidence of stillbirths.

The class of patients one is dealing with will, to some extent, determine the percentage of stillbirths. We find at the Long Island College Hospital and at the Methodist Episcopal Hospital two entirely different classes of patients; hence, we get a different stillbirth rate for each hospital. Again we get a different rate from those patients that are brought in or sent in by doctors who do not do competent prenatal work. Private patients too will have a different stillbirth rate. The prenatal clinic cases have the lowest stillbirth rate. Now as to a working classification of fetal deaths I would like to suggest the following: those that are dead on admission; those that die during labor but before delivery; and finally those that die during delivery.

The statistics from the Long Island College Hospital and Methodist Episcopal Hospital show about the same as Dr. Lyon's. In 2000 labors at the Long Island College Hospital, we had a stillbirth rate of 44 per 1000, including all classes of cases. A number of these cases came from extremely poor neighborhoods, were brought in by the ambulance or were referred by doctors and midwives. In 1000

cases from our prenatal clinic there was a rate of 24 per 1000. A former series from our clinic, tabulated by A. C. Beck, showed 18 per 1000. In 4000 consecutive labors at the Methodist Episcopal Hospital we had a stillbirth death rate of 24 per 1000. The private cases showed 26 per 1000, and the general ward cases 19 per 1000. Ward cases receiving prenatal care during the greater part of pregnancy showed 14 per 1000. Hence, it is evident that the stillbirth rate varies in proportion to the amount of prenatal care the patient receives, and the stratum of society to which she belongs.

In looking over the main causes of stillbirths in our series, they may be put down about in this order: toxemia, placenta previa, ablatio placenta, prolapsed or knotted cord or cord about the neck (an important factor in both the above series), macerated fetus with or without toxemia, probably syphilitic; syphilis; instrumental and breech delivery; intracranial hemorrhage and other cranial injuries; monsters and prematures.

DR. RUDOLPH W. HOLMES, CHICAGO, ILL.—The benefits which accrue from a rational routine supervision of the pregnant woman are no longer debatable. Prenatal care is one of the greatest prophylactic measures and has brought about a great amelioration of the incidence of morbidity and mortality of mothers and their children. It is unfortunate but true that only a few prenatal maladies may be recognized and then, largely only by reflection: syphilis and the toxemias, recognized in the mother, have their effects on the fetus definitely interpreted. By the x-ray gross developmental defects may be recognized. Twice it has been my fortune to recognize congenital heart disease before birth.

In Chicago, the Commissioner of Health, Dr. Bundesen, has issued a photostatic graph of the deaths, in hospitals, within the first two weeks of life: on a basis of 1000 live births, the deaths range in Chicago hospitals, from 18 to 147. This graph clearly shows that many women still go through pregnancy without prenatal care, and with something wrong in the attention during labor.

If we eliminate the inevitable sequences of the above conditions, syphilis, toxemias, maldevelopment, and unskillful obstetrics, we yet have a large number of fetal deaths of which we know little or nothing. Personal contact with a patient is essential in the proper interpretation of disease,—we have not that personal contact in the case of the unborn child. So we find a large proportion of fetal deaths are due to what Dr. Cragin denominated "congenital weakness" for lack of definite knowledge.

We know that fish produce an enormous number of eggs in the spawning season, a wise provision of nature, as so many of the eggs are lost directly or soon after fertilization has been accomplished. This biologic fact has its parallel in the human family; more children are produced than are needed. We see a similar parallel in the 200,000 ova in the newborn female child, few ever reaching perfection and fertilization.

DR. JOSEPH L. BAER, CHICAGO, ILL.—A comparison of statistics, of which this paper is an excellent example, is perfectly futile without a standardization. What is a stillbirth? The definition of viability is twenty-eight weeks, 1800 grams weight, 35 cm. length. The law of Illinois, the Bureau of Census at Washington, and the American Public Health Association recognize as a stillbirth a fetus that is born without movement, heartbeat or respiratory effort, and a fetus that is born with any one of those three phenomena is a live birth legally, quite regardless of viability. Therefore, if Hospital A chooses to regard viability as a criterion for its stillbirth incidence, Hospital B ignores viability, and Hospital C chooses to call a fetus a live birth at twenty weeks because it gasps once or twice and is then entitled to a death certificate, our figures are perfectly useless, and

until we can get some unanimity as to what constitutes a stillbirth we shall not be able to compare them.

DR. J. WHITRIDGE WILLIAMS, BALTIMORE, MD.—A number of years ago I collected and tabulated the deaths occurring in a series of 10,000 deliveries, which included all babies dying during the first two weeks of the puerperium. A considerable part of that series was before satisfactory prenatal care was employed. It was shown that the predominant cause of fetal death was syphilis, which was responsible for over 30 per cent of the deaths. The mortality of the last three years in about 3,500 cases, from the period of viability up to and including the first two weeks of the puerperium, was 6 per cent. I was very much interested in two things: first, to see that the prenatal care had reduced the deaths from syphilis from over 30 per cent to about 6 per cent. In this series, practically all the deaths from syphilis occurred in the children of women who had not had prenatal care. Consequently, intensive prenatal care has served to reduce the incidence of death from syphilis almost to the vanishing point.

The second thing that interested me in this study was to determine what proportion of the children died from cerebral injuries. Practically all of the 210 children in the series came to autopsy, and cerebral injuries were found in 6 per cent, only half the number in Dr. Lyon's report. I had expected to find it much higher. Likewise, just as he did, we found a very large incidence due to placenta previa and separation of the placenta.

The general result of my experience is that by efficient prenatal care we are able to do away almost entirely with the deaths due to syphilis. We are scarcely able to affect those due to placenta previa or premature separation. We can to some extent diminish the deaths due to toxemia. But we have a very considerable field for the reduction in the number of deaths due to dystocia, especially when associated with moderate degrees of pelvic contraction, and it is in this field that we can look forward to improvement in the future.

DR. J. P. GREENHILL, CHICAGO, ILL.—Our experience at the Chicago Lying-In Hospital has been essentially in accord with what Dr. Lyon has said concerning his study at the Woman's Hospital. However, our incidence of cerebral hemorrhage was only 19.7 per cent. We found that syphilis as a cause of stillbirth is not very significant, since it accounted for only 2.6 per cent of all our fetal deaths. The toxemias of pregnancy caused the death of a large number of fetuses, most of which were expelled prematurely. In a few of our cases pituitrin was the cause of death. The house staff practically never uses pituitrin during the first or second stage of labor, and the fetal deaths which followed the use of pituitrin occurred at the hands of attending physicians. At autopsy, babies presumably killed by the action of pituitrin showed a most intense congestion and pinpoint hemorrhages of the brain.

You may be interested to know that at the Chicago Lying-In Hospital during the past seven years we had nineteen fetuses which were monsters or had gross deformities. Seven of this number, or 36.8 per cent were associated with placenta previa. I mention this in particular, because a few years ago I tried to emphasize the not infrequent association of fetal monstrosities and deformities with placenta previa.

DR. LYON (closing).—In regard to the fetal heart our custom now is to have the heart rate taken during the interval between contractions, and if there is an increase or decrease of 20 points, it is reported to the resident.

It is not our custom to permit pituitrin either to induce labor or to hasten the second stage, without an order from one of the attending surgeons.

DR. JOHN A. SAMPSON, Albany, N. Y., read a paper on **Peritoneal Endometriosis, Due to the Menstrual Dissemination of Endometrial Tissue into the Peritoneal Cavity.** (For original article see October, 1927, issue, page 422.)

DR. EMIL NOVAK, Baltimore, Md., read a paper entitled **Ovarian Metastasis With Cancer of the Uterine Body. Is Transtubal Implantation an Important Factor?** (For original article see October, 1927, issue, page 470.)

#### DISCUSSION

DR. CHARLES C. NORRIS, PHILADELPHIA, PA.—At our meeting in 1921, Sampson presented his first paper upon this subject. I believe this and his subsequent work to have been the best research along gynecologic lines for many years. As is natural with any work which has attained international interest, Sampson's conclusions have not escaped criticism. The fact that such lesions as Sampson has described occur, and occur frequently, is now recognized. Whether the Sampson cysts be the result of transtubal dissemination of desquamated menstrual endometrium or due to a metaplasia of endothelium is of secondary importance, but is the point about which most of the discussion has developed. Novak, in this country, and R. Myer, in Germany, have headed the opposition to the transtubal theory.

The chief arguments against the transtubal theory are: (a) that the intramural portion of the tubal lumen is too small to permit the passage of desquamated epithelial cells, and (b) that the desquamated endometrium is devitalized or dead. On the other hand, the arguments in favor of the transtubal theory are: (a) the location of the implants; (b) the patency of the tubes; (c) the morphology of the lesions; (d) the result of animal experiments; (e) the fact that it is usually found in association with uteri in which some obstruction to the free outflow of the menstrual blood is present, and (f) that the endometrial-like tissue in the implants undergoes changes similar to those of the corporal endometrium and does so at the same time. This latter is one of the strongest arguments in favor of the müllerian origin of the transplants.

Endometriosis is in many respects similar to peritoneal carcinomatosis, both are spread by direct seeding and by lymphatic extension. In carcinomatosis the lesion consists of embryonal, rapidly growing cells, whereas endometriosis is the result of a normal adult cell transposed to a new environment and is probably of extremely slow development. Pseudomyoma of the peritoneum also in many respects resembles both of these conditions and lies midway between the two in point of rapidity of development.

Sampson has drawn our attention to a new gynecologic disease which in advanced cases often presents a fairly typical clinical picture and may ultimately prove the solution of many formerly unexplained gynecologic lesions and possibly the source of origin of various neoplasms.

Regarding the advisability of diagnostic curettage in cases of suspected fundal carcinoma, I believe the operation has a definite field. Fundal carcinoma is a malignant form of cancer. In an analysis of over 100 cases of this condition from the gynecologic clinic of the hospital of the University of Pennsylvania, the three year salvage was only about 34 per cent. Early diagnosis is essential; in our early cases we saved about 60 per cent to 70 per cent. The manifestations during the early stage are often vague and the earlier the disease, the less prominent are the symptoms. Bleeding and discharge are the chief symptoms. In patients in whom the disease develops at about the time of the menopause, the clinical diagnosis

is often especially difficult. Curettage offers a practically positive means of arriving at a diagnosis. The Clark test which consists in gently raking over the surface of the endometrial cavity with the point of a uterine sound is of distinct value, in that carcinoma of the fundus is a friable, vascular growth, and hence, this test is followed by a slight trickle of blood. This test should be performed under strict asepsis and can be utilized in the office. It is not positive, but if blood follows the sound, curettage should certainly be performed.

Accepting as I do the Sampson theory of transtubal dissemination of normal endometrium, it is but natural to feel that diagnostic curettage may occasionally result in the transtubal dissemination of fundal carcinoma. That this does not often occur is shown by the fact that actually better results were secured in our series of fundal carcinoma in those cases in which diagnostic curettage was performed than in those which were not submitted to this procedure. The explanation of this is probably that the cases upon whom diagnostic curettage was required were the earlier ones. I do not believe curettage should be performed as a routine or lightly undertaken. There are, however, a good many cases in which it offers the only method of arriving at a positive diagnosis, short of hysterectomy. Were we to eliminate diagnostic curettage from the list of justifiable operations, it would mean either that many benign uteri would be sacrificed or that many early carcinoma would be permitted to develop to the advanced stage. Diagnostic curettage can be safeguarded by thorough dilatation of the cervix, the avoidance of irrigation of the uterine cavity following the operation, or the avoidance of uterine packing, or anything which may interfere with the free drainage of the cavity. The application of radium at the completion of the operation is a definite and further safeguard. If the patient is merely suffering from a myopathic hemorrhage, the radium will nearly certainly cure the condition, whereas if a carcinoma has been curetted, the action of the radium is distinctly beneficial and probably destroys any loose cells which may have been left in the uterine cavity. As these suspicious cases generally occur in elderly women, the application of the radium has no drawbacks. I do not employ frozen sections for the examination of material obtained by curettage. The diagnosis, especially in the early cases, is such an important one that I prefer to delay a few hours and thus secure better specimens.

I would like to place on record the history of a case which I believe to have been one of transtubal dissemination of a fundal carcinoma. A woman, twenty-eight years of age, was brought to our ward with a diagnosis of incomplete abortion. The usual palliative treatment failed to check the hemorrhage. A curettage was performed and the specimens obtained were examined according to the routine method. The specimens were found to consist chiefly of normal endometrium, but a few fragments showed undoubted adenocarcinoma. The patient had left the ward three days after the operation and moved to another city; as a result six weeks elapsed before she could be brought back and a hysterectomy performed. A carcinoma about 1 cm. in diameter was present in the fundus, both tubes were normal, a papillary carcinoma about 2 by 4 mm. was present upon the upper and outer surface of the right ovary. This tumor was identical in its histologic structure with the carcinoma in the endometrial cavity. Radium was not used in this case, and it is probable that the curettage broke up and left behind in the uterine cavity small particles of the neoplasm and that the uterine spasm which followed, forced out some of these cells through the tubes, and that some of them found lodgement upon the surface of the ovary. This case is also of interest on account of the youth of the patient. In older patients, the tubes may be atrophied and their lumen lessened in diameter and as a result transtubal dissemination is less likely. In a definite proportion of our cases in which associated ovarian and fundal carcinomas have been present, the growths have been similar in their histologic structure. I would summarize by saying that curettage should never be performed unnecessarily,

that there is a danger of transtubal dissemination in the case of a fundal carcinoma, but that this danger can be largely eliminated by attention to technic and that by not performing diagnostic curettage in suspicious cases, the patient is submitted to a far greater hazard.

DR. JOSEPH BRETTAUER, NEW YORK CITY.—I consider Dr. Sampson's point of view somewhat radical and feel inclined to endorse the principles laid down by Dr. Norris. A recent case in my experience is unique. About six months ago a young professional woman was brought to me by her doctor, to be operated upon for multiple fibroids. Excessive menorrhagia and pain were the symptoms complained of for some months prior to my first examination. The attending physician had made a rectal examination( the hymen being intact) and found multiple fibroids reaching up to the umbilicus, with a large pedunculated nodule in the right inguinal fossa. The growth increased rapidly in size, bleeding was not controlled by internal medication, and operation was strictly indicated.

A supravaginal amputation of the uterus and a left salpingo-oophorectomy were done; the left ovary contained a large Sampson cyst and was densely adherent; the right ovary apparently was normal and was left in situ. An inflammation was found in the Douglas pouch, which rectal examination proved to be an infiltrated, ulcerated condition in the lateral rectal mucosa. The upper third of the rectum was resected, and a sigmoidorectal anastomosis was made. Recovery was uneventful.

It was only through the pathologist's report that the condition, which we thought was carcinomatous, was found to be an endometrial infiltration.

I would like to know if Dr. Sampson is prepared to say that this is a malignant condition, or whether such tissue should be left after the removal of the uterus and adnexa.

DR. WILLIAM P. HEALY, NEW YORK CITY.—It seemed to me that Dr. Sampson had in a very simple way explained a condition which I had met with clinically a great many times and had been unable to explain satisfactorily. I have met with a great many instances of endometriosis occurring in the culdesac, in young women, in which the rectum was pulled up on to the posterior surface of the uterus. In the first two cases I did a major operation, removing the rectum as well as the uterus and adnexa, and received a report that did not verify a malignant lesion. Thereafter when I met with the condition, I left it intact if it were in the culdesac, and in two instances in which there were chocolate cysts in the ovaries I resected enough of each ovary, as these women were young, to leave a fair amount of normal tissue. Each of the women has since conceived twice, gone through a normal labor, and the lesion in the culdesac is still there. So there are four children in those two instances of conservative surgery.

On the other hand, I have seen some patients who have had a good deal of distress from the lesion in the culdesac. They had consulted competent surgeons; exploratory celiotomy had been done; the surgeon concluded that the lesion was inoperable and sent the patient to me for treatment with radium on the theory that a carcinoma was present. I have identified the lesion as an endometriosis and treated it, with relief of the patient's pain, and I think there is no reason to hesitate to do that and avoid surgery where the lesion is located at that point.

Dr. Sampson emphasizes the constant location of the earlier lesion on the lateral surface of the ovary where fragments of tissue may very easily become attached to the ovary and the broad ligaments, or to the ovary and the uterus, because invariably that is where we find these lesions. The ovary is always adherent and has to be separated in order to perform any operation upon it.

With regard to Dr. Novak's communication I am absolutely in accord with all he says about the importance of the lymphatic route of extension in the uterus. On the other hand, we do see frequently at the Memorial Hospital, from the stand-

point of implantation, superficial metastases along the vaginal walls in cases of adenocarcinoma of the corpus. These are not lymphatic extensions; they can be easily rubbed off; they are multiple implants and the diagnosis of adenocarcinoma of the corpus can be made from them. We do see cancer emboli in the veins of the corporeal musculature. We operate on the theory of lymphatic extension and clamp the broad ligaments widely apart immediately on opening the abdomen and do not place any instrument in the corpus until we have thoroughly clamped the broad ligaments.

As to the danger of diagnostic curettage, I agree with Dr. Novak that it should be done, but I think the major operation should be done as promptly as possible after the curettage. On the other hand, one can make a diagnosis without curetting, by removing tissue by suction with a pipette which a pathologist should recognize as carcinoma if it be present. That has been done at the suggestion of Dr. James Ewing, who felt that curettage was dangerous. This is not a difficult thing to do; however, I prefer removal by the curette.

Regarding the age of the patient, we have had at the Memorial Hospital only a few patients in the menstruating age who have had undoubted carcinoma of the corporeal endometrium. Practically every one of our patients was beyond the menstrual life. I think that is important to bear in mind from the standpoint of diagnosis and treatment.

As to the use of radium in the body of the uterus, I think it should be used only when operation cannot be done, or when one is awaiting a microscopic report of the tissue obtained.

DR. I. C. RUBIN, NEW YORK CITY.—Among the points of interest is that the tube is so narrow as not to permit the passage of endometrial fragments. During normal pregnancy within the early days of impregnation which occurs in the tube, the ovum passes into the uterine cavity, and by that time it is an appreciable structure. At this blastula stage it would be equal to the size of some of the small endometrial fragments that Dr. Sampson has found in the tube and on the surface of the peritoneum, so that narrowness of the lumen cannot be advanced as a decisive reason against the transtubal spread of endometrial fragments during menstruation,—not even the narrowest lumen in the specimen encountered by Dr. Sampson which he has shown us on the screen. It is well known that the tube lumen is capable of dilating and contracting, as in the case of the transportation of the hen's egg from ovary through oviduct to the cloaca. Furthermore, the fallopian tube is capable of peristalsis and antiperistalsis.

Secondly, it is very probable that although the desiccated part of the endometrium is dead, small fragments near the basal layer of the endometrium coming away with it and going through the tubes retain enough vitality to regenerate themselves wherever they are implanted, in the same way as the residual basal portion of the endometrium in the uterine cavity.

The third point was the presence of some stimulus during menstruation which activates the endothelium to a degree of metaplasia, sufficient to resemble endometrial structures. I believe that some time during ovulation the follicular fluid is poured out from the ovary, is taken up by the tubes and stimulates their peristalsis. It is possible that that fluid also contains a hormone which induces the endometrial reaction in the uterus itself and at the same time perhaps the decidual reactions that we are all familiar with in studying sections of the peritoneal covering of the pelvic organs removed during menses and gravidity.

As to the mechanism of transtubal migration, it is easy to conceive how the fragments can be transported along the tubal lumen into the peritoneal cavity and fall into the fimbriated gutter, which Dr. Sampson has shown us, by direct transmigration of endometrial fragments. In those cases of so-called dysmenorrhea of

the colicky type, with either a spasmodic closure of the internal os or perhaps a rigid organic stricture of the cervix, where the menstrual fluid containing its endometrial portions collects, repeated uterine spasm can easily force this menstrual blood with its endometrial fragments through the tubes. The fact also should be taken into account that if one examines a patient during menses, the uterus may be squeezed to such an extent as to force some of the menstrual fluid through the tubes, thus causing a spread of these fragments in that way.

About the relationship between curettage and the transportation of endometrial fragments with the menstrual fluid, I believe that with a large curette blocking the cervical canal while the uterus is contracting, the spasm being incited by the instrument, one can force endometrial fragments through the tubes. Secondly, so far as the transplantation of carcinoma from the uterus along the tubes is concerned, Ewing for example, believes very strongly that carcinoma is spread by curettage. To overcome the possibility of spreading cancer cells by curettage, it might be well to get a biopsy by means of a cystoscope punch and take out a fragment of any portion of the uterine cavity desired. In that way one does not cause as much trauma as with the curette. I have used this instrument for several years for the purpose of obtaining small particles of uterine mucosa in the study of the functional condition of the endometrium in cases of sterility.

DR. EMIL NOVAK, BALTIMORE, MD.—The problem of the etiology of endometriosis is a difficult one to attack directly, and the various views which have been advanced are based practically altogether upon circumstantial evidence. Dr. Sampson, in the defense of his menstrual regurgitation theory, is thus placed somewhat at a disadvantage, as experimental or clinical proof of its correctness is impossible at present. A direct method of approaching the problem would be by growing in the peritoneal cavity the endometrium cast off at menstruation, but this would be foreordained to failure, if the results of tissue culture in general are to be accepted. In the discussion of this subject before this Society last year, I suggested that tissue culture studies of the endometrium might yield important results. For some months Dr. Herbert Traut, of the gynecologic department of the Hopkins Medical School, has been carrying on such studies. He has been able to obtain ready growth of the postmenstrual, interval, and premenstrual endometrium, but has not, as yet, succeeded in getting any definite results with menstruating endometrium. This work, however, is as yet in its infancy. The work of Jacobson, who studied the transplantation of endometrium to the peritoneum of lower animals, is of interest, but throws no light on the etiology of endometriosis.

I do not know the cause of pelvic endometriosis, but I do not believe that Dr. Sampson's explanation is the correct one. As I presented the arguments against it before the Society in my paper of last year, I shall not repeat them here. I believe, for reasons which I discussed in that paper, that the explanation of the condition revolves about the fact that all the surface tissues in which ectopic endometrium may be found have the same embryonic derivation as does the endometrium,—the germinal epithelium, the pelvic peritoneum, etc. All arise from the celomic epithelium, representing merely different degrees of differentiation. What the activating cause of the differentiation into endometrium is, I do not know, but it seems quite possible that it is something derived from the tubes, which, I agree with Sampson, are commonly open. Some of the epithelial cells of the tube are apparently of definitely secretory type, and may play a part in this process, but this is only conjectural at present.

The celomic differentiation theory of endometriosis will explain certain cases which cannot be explained by the regurgitation theory, such as the endometrial islands occasionally seen at the umbilicus, in the groin, or even in the vulva.



DR. ARTHUR H. CURTIS, CHICAGO, ILL.—Dr. Healy's statement relative to the infrequency of carcinoma of the corpus uteri during the menstrual age comes as a considerable surprise to me. In my private practice alone, within the last year, I have had four of these cases. I would like to hear a few words regarding the experience of others in this respect.

In contrast with Dr. Norris, Dr. Novak, and Dr. Healy, I am definitely opposed to diagnostic curettage unless it is absolutely necessary. I venture that it is performed at least ten times as frequently as it should be. We must not forget that practically every woman who is past the menopause, ruling out easily demonstrable uterine polyps, has in the bleeding alone pathognomonic evidence of carcinoma of the uterus. In my experience only three patients have been exceptions to this rule. Two were diagnosed as having recurrence of menstruation; one, four years after supposed menopause, the other, five years after supposed menopause, because they had breast discomfort and other phenomena suggestive of oncoming menses before the bleeding occurred.

DR. NORRIS—I did not infer in my discussion that I thought diagnostic curettage should be used routinely in all cases. I meant to convey the idea that diagnostic curettage has a definite place in doubtful cases and that I believe many cases could only be diagnosed in that way, particularly the early ones.

DR. SAMPSON (closing).—I have encountered only six cases of ovarian carcinoma associated with a similar growth, apparently arising in the uterine mucosa. Three of these were reported in the paper referred to by Dr. Novak. I have been greatly interested in the study of the lymphatics of the uterus as channels for the dissemination of cancer from that organ. The lymphatic distribution of cancer from the uterus to the ovary was not considered in this article, because I was not quite sure that it could occur, and even so I did not think that it applied in these three cases.

In one patient both an adenocarcinoma and possibly a stromal celled sarcoma of the uterine mucosa were present. There was an associated peritoneal carcinomatosis or sarcomatosis (Fig. 30 of previous article), in which the lesions were all superficial. These were present on the surfaces of both ovaries and also on the terminal loop of the ileum as well as on other structures in the pelvis. It seemed to me that the patent tubes offered the best explanation for the distribution of the peritoneal implantations as well as those on the surfaces of the ovaries. In another patient, a peritoneal carcinosis, with a distribution readily attributed to material escaping through the patent tubes (Fig. 38) was associated with a carcinoma of the uterine mucosa. A small implantation-like lesion of cancer was present on the surface of one of the ovaries. In the third case (Fig. 46), a papillary type of adenocarcinoma was present in both ovaries and apparently had developed on the surface of these organs. There was an associated adenocarcinoma of the uterine mucosa evidently arising from the uterine epithelium. Both tubes were patent.

Since this article was published, I have had three additional cases of carcinoma of the ovary associated with a similar growth, apparently arising in the uterine mucosa. In one the growth in the ovary and in the uterus was extensive and that in the uterus apparently arose from the uterine epithelium. There was no evidence of cancer on the surface of the ovary. It would seem that if one was secondary to the other, the cancer must have been transmitted through vascular channels, and I would favor the veins rather than the lymphatics. I have never been able satisfactorily to inject the lymphatics in a retrograde manner. The intrinsic veins of both the uterus and ovary are easily injected through the uterine and ovarian veins. Fragments of cancer were found in the lumen of the interstitial portion of the tube. It was a difficult operation, and in handling the uterus, bits of cancer in the uterine cavity might easily have been forced into the lumen of the tube.

In the second case of this series an adenocarcinoma was present in one cornu of a double uterus (single cervix). The fimbriated end of the tube of that side was occluded and fused with the surface of the ovary. Multiple patches of cancer had arisen in the mucosa of the distal portion of the tube and fragments of cancer were found in its lumen. Cancer was present on the surface of the ovary adherent to the tube and also enmeshed in the surrounding adhesions. I believe that fragments of cancer escaped from the uterine cavity through the tube and became implanted on the surface of the ovary and that subsequently the fimbriated end of the tube became occluded as it does in the reaction to bacterial infection.

The third case was even more interesting. The patient, aged fifty, married and never pregnant, was menstruating regularly, she thought, after a temporary cessation of her menses. On examination an indurated mass was palpated in the posterior culdesac which presented in the vaginal vault behind the cervix. A preoperative diagnosis of endometriosis was made. At operation, implantation-like lesions were found on the lateral surface of both ovaries, appearing exactly like the lesions of a benign endometriosis. The bottom of the posterior culdesac was occluded by the fusion of the rectum with the cervix, as occurs in a benign endometriosis in this situation. Both tubes and ovaries, the uterus, the mass in the culdesac, together with a portion of the posterior vaginal wall, were removed. On incising the uterus, an evident cancer of its mucosa was present. Even then I thought it was associated with a benign endometriosis of the ovaries and in the culdesac. To my surprise the implantation-like lesions on the surface of the ovaries and in the culdesac had the same histologic structure as that of the cancer of the uterus. Many theories may be advanced to explain the distribution of the cancer in this case. I believe that the implantation of fragments of cancer escaping from the uterine cavity through the patent tubes is the most logical theory. I wish that I might have had the opportunity to study more cases of cancer of the body of the uterus associated with a similar growth in the ovary. In four of the six cases which I have studied, the patent tubes offered to me the most logical avenue, by which the cancer was carried from the uterus to the ovary.

Dr. Novak has referred to my practice of ligating the fimbriated ends of the tubes, to prevent the dissemination of cancer into the field of operation, before handling the uterus in abdominal hysterectomy, when cancer of the body of the uterus is suspected or known to be present. It is quickly done, and I believe that it increases the chance of a permanent cure. I have found fragments of cancer in the tubes of five uteri removed for cancer of the body of that organ. There had been a preliminary diagnostic curettage in four of these.

I still follow the rules laid down in my previous article to prevent the dissemination of cancer in the diagnosis and treatment of cancer of the body of the uterus. They are as follows:

1. A patient in whom cancer of the body of the uterus is suspected should be examined with great care and gentleness.

2. The diagnostic curettage should be employed only in doubtful cases or poor operative risks and, if used, should be done very gently.

3. Radium should not be used, as the insertion of the capsule containing the radium acts as a plunger of a piston syringe, forcing contents of the uterine cavity into the tubes.

4. Abdominal hysterectomy with the least possible manipulation of the uterus and the closure of the channels, through which material may escape from the uterus into the field of operation, offer the best chance for a permanent cure. The fimbriated ends of the fallopian tubes should be first ligated; the ovarian vessels, round ligaments, and uterine vessels should be doubly ligated, cutting between

the ligatures; the vagina should be clamped below the cervix and carefully cleansed before severing the vagina below the clamp and removing the uterus.

I have been criticized for my practice of using "the diagnostic curettage in patients with uterine bleeding only in those in whom I do not suspect cancer or when I considered the patient a poor operative risk." If the patient is past the menopause and the bleeding is obviously coming from the body of the uterus and is increased by bimanual palpation, I suspect a cancer of the body of the uterus. In younger women and, especially in patients suggesting a myofibrosis, I do not suspect cancer and a diagnostic curettage is done. Occasionally carcinoma is found in the scrapings obtained by curettage from these patients and occasionally, but very rarely, a uterus is removed when cancer was suspected and it is not found.

This month a patient came under my care with a history of uterine bleeding of several months duration. The uterus was irregularly enlarged, and a diagnosis of multiple leiomyomas was made. I thought that a carcinoma of the body of the uterus was also present. The patient was large, anemic, seventy-two years of age, and appeared to be a poor operative risk. For these reasons a diagnostic curettage was done and adenocarcinoma was found. I hesitated between the use of radium and the removal of the uterus, but finally decided on the latter. A few days later the uterus was removed. At operation the posterior surface of the uterus and other structures in the culdesac were stained with blood, and the left tube was filled with blood. The uterus contained multiple leiomyomas. It was evident that the chance for a permanent cure had been greatly lessened by the curettage.

Dr. Scott asked about the origin of the stroma in misplaced endometrial tissue, whether uterine epithelium transplanted to other parts of the body carries stroma with it or may develop it from the tissue in which it lodges. The same question may be asked of the stroma surrounding the uterine epithelium of an endometriosis arising from the invasion of the uterine wall by the mucosa lining the uterine cavity. In both instances it sometimes is difficult to determine whether the stroma is arising from or replacing the tissues invaded. I have thought that in both situations stroma, at times, might arise from the tissues of its host.

Dr. Brettauer asked about the treatment of endometriosis of the sigmoid and whether or not it was malignant. Cancer invades, metastasizes by implantation and through vascular channels. Furthermore, it is lawless and continues to grow, unless it is entirely removed or destroyed. Endometrial tissue sometimes is invasive, and I believe may metastasize by implantation and through vascular channels. Fortunately it is not lawless but it subservient to the function of the ovary. Dr. William P. Graves has brought out an excellent point in the treatment of extensive endometriosis of the sigmoid with resulting narrowing of the lumen of the intestine, and that is not to resect the sigmoid but to remove all ovarian tissue and make a temporary colostomy. I have tried this in one case with excellent results.

I wish I knew more about the so-called implantations of cancer sometimes found in the vaginal wall of patients with cancer of the body of the uterus. I have thought that some of these were implantations and others might be metastases, and I would favor the veins rather than the lymphatics, as metastases of chorioepithelioma occur in this situation.

I believe that the ovaries and the tubes are the chief distributing agents for the cause of peritoneal endometriosis. Patent tubes evidently play an important rôle in the etiology of this condition. The endometrial tissue in the peritoneal lesions resulting from the escape of material from the ovaries and tubes must arise either from the implantation of cells carried with it or from a metaplasia of the peritoneal mesothelium brought about by its stimulation by some specific irritant present in this material.

Judging by the short time required for blood to escape from the uterine cavity

into the tubes during curettage, menstrual blood which often contains bits of the uterine mucosa might likewise quickly pass from the uterine cavity into the tubes.

Cron and Gey have recently shown, by tissue culture, that the endometrium cast off by menstruation is viable. (AM. JOUR. OBST. AND GYNÉC., 1927, xiii, No. 5, pp. 645-647.)

Replying to Dr. Curtis' question whether I favor diagnostic curettage in women who have inexplicable uterine bleeding prior to the menopause: In most cases I do, unless I find some other reason for removing the uterus. If the patient is past the menopause and has uterine bleeding, I suspect cancer; if before menopause, I do not suspect it. Every patient with uterine bleeding that comes under my care is advised to have either a curettage or an hysterectomy, which depends on the individual case.

DR. CARL HENRY DAVIS, MILWAUKEE, WIS.—The difficulty in the tissue culture work referred to by Dr. Sampson is in being absolutely sure that one is getting tissue that is being cast off. Tissue removed by a dull curette, does not answer strict requirements. It is also possible that a pipette may dislodge tissue that had not already been cast off. Endometrial tissue obtained from vaginal secretions frequently shows deeply staining nuclei and is believed to be alive, but it cannot be used for cultural purposes because of bacteria. Mr. Gey has grown with ease bits of tissue obtained from the interior of a uterus which I removed from the patient during menstruation.

DR. NOVAK (closing).—As most women with adenocarcinoma of the uterus are well beyond middle life, the tubes are small and atrophic, with probably no peristaltic activity, so that it would be hard to conceive that they could transmit cancer material outward to the peritoneum. On the other hand, I was surprised to hear that Dr. Healey had encountered only two cases in women still in the menstruating age. In almost all the reports in the literature, the experience appears to have been that nearly one-fourth of the cases occur in women not over fifty. Our own study showed about the same incidence. The diagnostic method mentioned by Dr. Healey, of aspirating material from the uterus by a pipette, can scarcely be of value except in the advanced case. It would be very unreliable, it seems to me, in the cases of early or circumscribed type, especially if the growth be high up in the uterine cavity, for in these it could hardly be expected that any material could be sucked out with a pipette.

In the additional case reported today by Dr. Sampson, in which the distribution of the cancer in the pelvis resembled that of endometriosis, it seems to me, as Dr. Sampson anticipated, that the route was probably lymphatic. I had rather expected that Dr. Sampson might have suggested that there had been a malignant degeneration in an originally benign endometriosis, as he has reported several analogous cases in the ovary.

I feel rather strongly about the importance of diagnostic curettage in all except the rather obvious cases of adenocarcinoma. Regardless of what we suspect clinically, we are sure to meet many surprises. At times we will find cancer where we did not suspect it, at other times we will be agreeably surprised to find no cancer where we were almost sure of its existence. It is therefore, to my mind, not justifiable, except in the occasional case, to be guided as to the advisability of panhysterectomy by clinical impressions, when we have at our disposal, in diagnostic curettage, a quick and certain means of settling the question. This should be urged more, rather than less, widely, for there is no question that too many uteri have been removed unnecessarily because of clinical suspicion alone. Even in older women, uterine bleeding does not invariably mean cancer. On the other hand, bleeding in women below the menopausal age may, in a not inconsiderable proportion,

be due to cancer. I know of no other way of determining this point except by diagnostic curettage, preferably, as I stated in my paper, associated with immediate diagnosis from a frozen section, and followed at once, if cancer be found, by radical operation. In no other way can we be reasonably sure of not subjecting a certain number of women unnecessarily to a grave operation, and in no other way can we save another large group by recognizing and eradicating cancer in an early, easily curable stage. If a relative of mine beyond fifty had uterine bleeding, which was not profuse or of very long duration, or if such a relative below fifty had uterine bleeding, of any amount or duration; if, in other words, we were not dealing with a case of very obvious cancer, I should not want even an expert operator to perform a panhysterectomy until the presence of cancer had been demonstrated by diagnostic curettage.

DR. EDWARD A. SCHUMANN, Philadelphia, Pa., presented a paper entitled **Observations Upon the Coexistence of Carcinoma Fundus Uteri and Pregnancy**. (For original article see October, 1927, issue, page 573.)

DR. JAMES C. MASSON, Rochester, Minn., read a paper on **Total Versus Subtotal Abdominal Hysterectomy**. (For original article see October, 1927, issue, page 486.)

#### DISCUSSION

DR. FRANK A. PEMBERTON, BOSTON, MASS. (by invitation).—I will discuss Dr. Masson's paper. I am much surprised to find that I have no figures that compare with his at all. At the Free Hospital for Women, in Boston, from 1894 to 1926, there have been done 2,066 supravaginal hysterectomies for nonmalignant conditions, and in the same time only 22 complete hysterectomies for nonmalignant conditions. 'Supravaginal hysterectomy' was done for fibroids in 995 cases, for pelvic inflammation in 762, and the rest were for various diseases. The reason for using the supravaginal method is that we believe there is somewhat less mortality and morbidity. We think the operation is easier, that there is less danger of sepsis, and that the vagina is not shortened at all. We believe that it is shortened if the cervix is removed. To prevent future trouble from leaving the cervix in, we examine it carefully after the patient is anesthetized, do a biopsy if necessary, repair lacerations, cauterize it if endocervicitis is present, or amputate it if it is hypertrophied. We do any other plastic work that may be necessary and then the supravaginal hysterectomy. We have had no sepsis from cauterizing the cervix.

In regard to coring out the cervix, we have done that only six times. We amputate below the internal os by a wedge-shaped incision and leave very little of the mucosa of the cervix. We find there is danger, in coring out the cervix, of a postoperative hemorrhage, either immediately after or from eight to ten days later.

We always do a myomectomy if possible, and we feel that there are less chances of getting adhesions by doing a suspension also.

We have seen 19 cases of carcinoma of the cervix after supravaginal hysterectomy. Of those 19 cases careful examination and study of the history showed that 10 of them had no cancer at the time of the hysterectomy; 5 did have cancer, and in 4 there was a question as to whether they had or not. Ten of these 19 cases had been operated upon at the Free Hospital, and 2 of them probably had cancer at the time of the hysterectomy.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—The important point in these papers, it seems to me, is the question of the incidence of cancer in the stump after supra-

vaginal hysterectomy. While I am thoroughly in accord with the speaker that probably the average operator can do a supravaginal hysterectomy with greater facility than a panhysterectomy, I believe that if he is going to do a supravaginal hysterectomy, he must take into consideration the fact that cancer may occur in the retained stump, that it is a definite entity, and that this structure must be taken care of not only because of the fact of the cancer, but because of the incidence of cervicitis which is so frequently caused by trauma. Whether this is taken care of by an excision of the cervix or with the cautery, which we are using at the present time, or whether it is done by panhysterectomy is immaterial.

DR. WILLIAM P. HEALY, NEW YORK CITY.—There is no doubt that Dr. Schumann's case is an unique instance of carcinoma in the corporeal endometrium, and I think it is very fortunate that it is unique, because otherwise what an unsatisfactory situation there would be in the presence of bleeding of any type in an early pregnancy. Instead of putting the patient to bed and trying to prevent an early abortion, it would be necessary to empty the uterus.

I have stated that carcinoma of the corporeal endometrium practically never occurs during the childbearing period of life. I had a patient very recently, only thirty-seven years of age, who had carcinoma of the corporeal endometrium, but she had already entered her menopause; she had not menstruated for two years. Almost every patient I have seen had stopped menstruating. I do not mention any age, but they have invariably had an amenorrhœa over several months indicating that they were entering the normal menopause.

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## THE OBSTETRICAL SOCIETY OF PHILADELPHIA

*STATED MEETING, FEBRUARY 3, 1927*

### DR. JAMES F. CARRELL, of Philadelphia, described **A Case of Secondary Abdominal Pregnancy.**

Mrs. C. G., aged forty, was first seen on October 2, 1926. Her only acute illness was a mild attack of scarlet fever in early childhood. Until three years ago menstruation was regular every twenty-eight days, but since 1923 it usually came on every three weeks. The discharge was quite free and was occasionally accompanied by clots. The last period occurred on June 15, 1926, was of five days' duration, associated with the expulsion of several clots and accompanied by considerable pain. This period was followed by a brownish, vaginal discharge.

The patient was married at the age of twenty and had had four previous pregnancies. Three went to full term, and labor took place normally. One pregnancy terminated in a miscarriage at four and one-half months, shortly after the birth of the first child. She was widowed and remarried nine years ago, and had not been pregnant since the second marriage.

In the early part of July she was examined, and a diagnosis of uterine myoma was made. Accordingly, she was advised to have a series of roentgen-ray treatments and was exposed on several occasions to cross-fire.

On July 24 she was seized with a very severe attack of abdominal pain immediately after an x-ray exposure. Each subsequent x-ray treatment precipitated a similar attack of pain. There was no nausea or vomiting.

Examination on October 2 showed the abdomen slightly distended and moderately rigid, and the entire lower portion was exquisitely tender. A large, painful, and

tender mass was found rising out of the pelvis, rather rotund in outline, which seemed to be fairly adherent in the left iliac fossa. There was no vaginal discharge, and the breasts were negative.

Digital examination disclosed the cervix high up in the vaginal vault, displaced far to the left, reached with difficulty, and not noticeably soft or enlarged. Pressure in the vaginal fornices provoked intense pain. The pouch of Douglas, with the pelvis in general, was filled with an irregular, resistant, and tender mass. The temperature was 101° F., and the pulse was 100. A tentative diagnosis of pelvic inflammatory disease was made and, accordingly, an operation was thought unjustifiable. At this time the amenorrhea was attributed to the x-ray exposure.

On October 3, under ether narcosis, a posterior vaginal incision was made. On entering the pouch of Douglas, a large quantity of serosanguinous material escaped, followed by a rather profuse hemorrhage.

The vaginal opening was packed temporarily with iodoform gauze. A free median abdominal incision was then made. On incising the peritoneum a small amount of fresh blood was found free within the peritoneal cavity. The uterus was



Fig. 1.

resting in the left side of the pelvis, apparently forced into this position by a large mass, which seemed to have its origin in the right tube or ovary. There were no omental or intestinal adhesions. The uterus, with the large mass, was delivered through the abdominal wound. The uterine body was studded with numerous fibroid tumors, and this organ, with the correlated mass, was removed. (Fig. 1.)

An examination of the specimen showed that the left tube and ovary were normal. The uterine end of the right tube was somewhat altered owing to the proximity of the gestation sac. The right ovary had been firmly compressed by the pregnancy and was almost completely destroyed. It was thought that the uterine myomas were in some way etiologically responsible for the extrauterine condition, since there was no other evidence of pelvic disease. It was altogether likely that the pregnancy began near or in the fimbriated end of the right tube, because there was no evidence of tubal rupture.

The placenta was freely attached to the posterior surface of the broad ligament and the right side of the pelvis.

The fetus, a male, nineteen centimeters in length, was well formed and probably in its fourteenth or fifteenth week of development.

The recovery of the patient was uneventful; she left the hospital in good condition twenty-eight days following the operation.

**DR. LEONARD AVERETT, reported a case of Accessory Uterus With Arrested Pregnancy.**

Mrs. V. P., referred August 31, 1926, gave a history of having aborted a three months' pregnancy on April 20, 1926, and while the fetus had not been seen to have passed, she nevertheless had bled profusely for ten days, passing organized tissue (presumably placenta) and large blood clots, and had suffered severe pain in the lower abdomen, intermittent in character. The uterus remained enlarged, corresponding in size to that of a three months' pregnancy. The patient was nineteen years of age; married one year; menstruation started at the age of sixteen; irregular (intervals of one to three months); three to four days' duration; not painful nor profuse.

Since the supposed miscarriage on April 20, she had been menstruating for about four days every two weeks, flowing profusely and passing clots for three days; her last menstrual period being August 27, 1926.



Fig. 1.

Examination showed the uterus symmetrically enlarged (corresponding in size to that of a ten weeks' pregnancy), rather soft, freely movable, and in the anterior position. No adnexal pathology or tenderness was palpable. Examination of the breasts, showed no change.

On September 21, the patient was sent into the Gynecologic Ward of the St. Agnes Hospital. Her chief complaint at this time was pain in the left lower abdomen and irregular vaginal bleeding. A vaginal examination disclosed findings different in character from those found upon the previous examination. The uterus was much smaller than normal, typically infantile in development, and pushed to the right; the right adnexae were not palpable. To the left of the uterus there was a mass about the size of a large orange, freely movable, rather dense, and very tender upon palpation. Taking into consideration its position, density, and regularity in outline, a diagnosis of dermoid cyst of the left ovary was made.

Patient was operated upon September 23, and there was found an infantile uterus with a right tube and ovary and a right round ligament; from the left



cornua (where one would expect to find the beginning of the left tube) there was a small band (about half an inch in length) at the end of which was a spherical mass, with the left tube and ovary arising from its uppermost left portion and the left broad ligament inserting into it. This mass was removed, conserving the left tube, ovary, and round ligament, which was sutured to the left cornu of the infantile uterus. (Fig. 1.)

Upon opening the mass, it was found that its walls consisted of well-developed muscle tissue, the entire cavity was lined with a placenta, and in the center was a fetus showing signs of having undergone maceration.

Patient made an uneventful recovery and was discharged from the hospital October 7, 1926. She is now menstruating every 28 days, a normal flow of four to five days' duration.

### DISCUSSION

DR. GEORGE W. OUTERBRIDGE asked if the so-called accessory uterus had any separate cervix presenting in the vagina apart from that of the main uterus. In other words, what was there to prove conclusively that the mass was really an accessory uterus and not merely a somewhat atypical tubal pregnancy?

DR. ALFRED HEINEBERG wanted to know if the band which connected this mass to the uterus showed tubal tissue.

DR. AVERETT said there was evidence of a cervix in the accessory uterus, and there was no connection with the vagina, but there was a small opening in the band which connected the accessory uterus with the infantile uterus, and a fine probe could be passed through it. The predominance and compactness of muscle tissue differentiated it from a dilated fallopian tube. He could not demonstrate any endometrial tissue because the entire uterine cavity was covered with placenta.

DR. P. BROOKE BLAND, reported a case of *Dicephalus*.

The patient, twenty-eight years of age, had her last period February 10, 1926. She had one previous normal pregnancy and labor.

Following a period of amenorrhea, lasting from February 10 to the middle of May, 1926, the patient complained of slight irregular bleeding, combined with intermittent attacks of mild pelvic pain. This was regarded as a threatened abortion. The bleeding or spotting continued for almost three weeks and then gradually subsided.

During this time the patient was kept absolutely quiet in bed and under the influence of sedatives. From the middle of May until October 20, the day labor began, the general health of the patient was exceptionally good. At no time did she suffer with symptoms of toxemia, though for two months prior to delivery the abdominal distention was much greater than in her previous pregnancy.

Spontaneous rupture of the membranes was provoked, the patient stated, by straining while in an exaggerated stooping position. There was no other sign of impending labor. The patient was delivered three and one-half hours after active labor started.

The breech presented with the left foot protruding from the vulva. Efforts to extract the fetus were difficult. Finally the body and one head of the infant, a female, were delivered. Another head was noted in the pelvic cavity. After some manipulation the second head was delivered without special difficulty, although the patient sustained an extensive laceration of the posterior vaginal wall and perineum.

Owing to her favorable condition after the completion of the third stage, a primary repair was performed.

The fetus (Fig. 1), weighing 3280 grams, did not show serious signs of asphyxia. It was born alive, and inspiration and expiration were observed for more than a minute.



Fig. 1.

#### DISCUSSION

DR. GEORGE M. BOYD said he reported a similar case of dicephalus in 1901 from the Philadelphia Lying-In Charity Hospital. The patient had been in labor forty hours, the abdomen was irregular in outline, and the fetal heart was not heard. The cervix was dilated and the membranes ruptured. The head was presenting, well engaged. Without suspecting so unusual a monster, an attempt was made to deliver with forceps, but traction failed to advance the presenting part, and he thought the obstruction was due either to impacted shoulders or else to an amniotic hernia. A manual exploration of the uterus then revealed two heads attached to a common trunk. As the patient's condition did not warrant abdominal section, the uterus was emptied by first decapitating the head engaged and then performing podalic version. The well-nourished male fetus weighed  $8\frac{1}{2}$  pounds. Both heads were well formed, the extremities were normal, there were two hearts in one pericardial sac, and two aortae and pulmonary arteries. There were two spinal columns. The pelvis was single, and there were two ascending colons running parallel.

DR. NORMAN L. KNIPE, in 1912, had a similar case at the South Eastern service of the University.

The monstrosity had two heads, each normal in size and appearance, two

chest fused together, four arms and two normal legs, with a small rudimentary leg attached to the base of the spine.

The case was especially interesting because the mother had just given birth to a stillborn child, normal in appearance and size. The student in charge thought there was a twin child still to be born, but as it made no advance, he called a consultant. The consultant attempted version but failed. The patient was then sent to the University Hospital where a cesarean operation was done in preference to a difficult craniotomy. The dicephalic monstrosity was delivered, and the mother made an uneventful recovery.

## NEW ORLEANS GYNECOLOGICAL AND OBSTETRICAL SOCIETY

MEETING OF APRIL 7, 1927

DR. A. F. HEBERT read a paper entitled **Hernia Funiculi Umbilicalis, with Report of Three Cases.** (See page 86.)

### DISCUSSION

DR. HILLIARD E. MILLER had seen two cases of this sort. The first child, which had been delivered outside of the hospital, was brought in four hours later, after the hernial sac had ruptured, with four feet of small bowel lying free on the skin. The hernia was reduced and the abdomen closed, but death followed in five days, from peritonitis. The second case was seen in consultation, before delivery. The presentation was breech and the labor had been protracted. Delivery was effected without special difficulty, as far as the breech, at which point progress halted. Finally, after considerable traction, something was felt to give way, and it was thought a hip had been dislocated. An eight and a half pound child was eventually delivered, which presented a complete absence of the anterior wall of the abdomen. All the abdominal contents, stomach, liver, gall bladder, pancreas, small bowel, ascending and transverse colon, and appendix, lay on the outside. The child was much shocked, and though its heart continued to beat for some time, it never revived. There was no attempt at operation.

DR. HAROLD CUMMINS (by invitation) discussed these hernias from the standpoint of embryology. He pointed out that there are two grades, and that the minor grade represents simply a continuation or persistence of a limited herniation which is normally only transient. He exhibited specimens of normal feti, of approximately two months, and pointed out that at this time loops of ileum are pouched into the root of the umbilical cord, and are normally withdrawn into the abdominal cavity about the tenth week, whereupon the umbilical extension of celom is obliterated, just as the inguinal canal is closed after the descent of the testis. Any factor which prevents this withdrawal causes the minor grades of hernia. The more extensive hernias are associated developmentally with fissures of the anterior body wall and are not of the same genesis. He exhibited specimens showing extreme herniation of the latter type, and added that the child who had been exhibited by Dr. Hebert represented the same grade. He said that the origin of the more extreme cases is to be traced from the period in which the anterior body wall is in process of formation when all peritoneal contents are exposed directly to the exocoelom. Closure of the cavity is finally effected through growth of the somatopleure and amnion, which extend progressively further towards the body stalk, until finally the amnion encraps it completely, the former wide extra-amniotic communication thus being ultimately reduced to the culdesac in the

umbilical cord. Incomplete extension in this process is responsible for the major grades of umbilical hernia. The character of the eventration depends upon the location and extent of the defective closure of the body wall, and the development of this type of hernia is essentially different from that of the minor grade. The present view in embryology, suggested by the results of experimentation with the embryos of animals, holds that anatomically diverse defects, hernias, harelips, cleft palate, defects of the central nervous system, indeed any maldevelopment, may arise through the action of a single causative factor. Its selectivity in producing the defect is determined by the embryonic period in which the influence is exerted on the developing embryo. The vicious agent operates through the retardation of the normal rate of development, particular organs or regions suffering in accordance with the susceptibility associated with their state of elaboration at the time. An obvious corollary is that different agents may produce a like defect if their action be manifest at equivalent periods of development, the two being equally effective in retarding developmental processes. The cause of umbilical hernia is therefore to be sought among such factors as endometrial pathology or maternal toxemias, or similar generic mechanisms of retarded development.

DR. W. E. LEVY emphasized the importance of Dr. Cummins' remarks from the clinical side. The cord should be palpated carefully and tied at least an inch from the abdomen, as death might follow the inadvertent inclusion of a knuckle of bowel.

DR. HEBERT, in closing, emphasized the fact that prompt operation was the only means of saving these children, and that it should be done as soon as an operating room could be prepared, since after a few hours the formation of adhesions by the amnion and Wharton jelly made the procedure much more difficult.

### DR. LEWIS H. LEVY reviewed *The Theory and Pathology of Ovarian Dermoids*.

DR. C. JEFF MILLER said that as torsion was fairly frequent during pregnancy and the puerperium, this should always be borne in mind as the possible cause of acute abdominal pain and associated symptoms at these times. He had recently seen an interesting case in which, eight days after labor, the patient had developed colicky pains over the abdomen, and some fever. A definite mass was attached in the region of the gall bladder, and some upper abdominal pathology was suspected. Operation at the end of a month, showed a dermoid attached to the liver; it had apparently been carried upward during pregnancy, become twisted during delivery or in the early days of the puerperium, and its pedicle had become sufficiently attenuated, as involution occurred, to reach down to the pelvis, leaving the body of the cyst attached to the liver. He had also seen a case in which the dermoid was attached exactly under the umbilicus.

DR. HAROLD CUMMINS remarked that teratomata possess some features which are common to artificial cultures of embryos. In the latter the components vary in accordance with the origin of the stock, and under suitable conditions attain an abortive organization. A teratoma, in his opinion, might be regarded as a culture developed under conditions which are unfavorable to proper organization of the embryonic parts. A teratoma differs from tumors generally in that it originates from a cell possessing more comprehensive potencies of differentiation. On account of this possession, the parent cell might be considered a germ cell, but the occurrence of such varied degrees of development of the product suggested that this definition was not strictly necessary. In his opinion it was difficult to conceive of the universal application of the blastomere theory.

DR. PETER GRAFFAGNINO reported two cases in which a dermoid complicated pregnancy. The first patient, five months' pregnant, was admitted with apparently

the symptoms of acute appendicitis, although the temperature was not elevated, and the blood count was normal. A normal urine eliminated pyelitis, and while the patient was being observed, the condition cleared spontaneously. Three days later, without warning, a similar acute attack occurred, complicated by a considerable degree of shock. Immediate operation revealed an ovarian dermoid with a twisted pedicle, quite gangrenous. It was excised, and her recovery and the ensuing delivery were without incident. The second patient furnished a rather vague history of a six months' pregnancy, although examination disclosed her to be but three months' pregnant. Her symptoms suggested appendicitis, but a large mass in the upper abdomen led him to believe the condition to be an ovarian cyst with twisted pedicle. X-ray confirmed the presence of two distinct tumors, and operation revealed a dermoid, with twisted pedicle. This recovery was also uneventful. Both cases, he thought, emphasized the necessity of bearing in mind this condition as a complication of pregnancy at any stage as well as of the puerperium.

DR. MAURICE J. GELPI read a paper entitled **Rupture of the Uterus in the Scar of a Previous Cesarean Section, Occurring Twice in the Same Patient within One Year.** (See page 85.)

#### DISCUSSION

DR. PETER GRAFFAGNINO quoted the figures from Charity Hospital, which showed that in the last 11,516 cases delivered in that institution, rupture had occurred thirty-one times, an incidence of about one in every three hundred seventy-one cases, including all types, spontaneous as well as postoperative. The usual incidence of 2 to 4 per cent quoted for rupture after cesarean section suggested again the question of how to deliver a woman previously delivered by cesarean section. Reports in the literature of women who had had as many as eight subsequent spontaneous deliveries after the first cesarean delivery, and particularly reports of podalic versions and protracted labors after operative delivery, persuaded him that provided proper precautions were taken, delivery in hospital, under close scrutiny, furnished a sufficient margin of safety for the patient. In contracted pelvis, of course, there was no option but to repeat the cesarean. He pointed out that since about a fifth of all ruptures after cesarean section occurred between the seventh and eight months, the fallacy of depending only on a second cesarean to avert this catastrophe was apparent.

L. L., a colored woman, was admitted to Charity Hospital at the beginning of the eighth month of her tenth pregnancy. The previous nine deliveries had been spontaneous, and the puerperia all afebrile. Labor began some three weeks later, and was quite normal, though progress was rather slow. Because the patient's previous history was so well known—indeed she was a hospital character—the interne paid very little attention to her. Finally, late in the afternoon, when the head was down on the perineum and the cervix was fully dilated, he gave her two minims of pituitrin. Almost immediately afterwards he was informed by the nurse that the patient was badly shocked and bleeding profusely. He had left her with the head on the perineum, now he found it retracted, and the child definitely palpable under the abdominal wall. The diagnosis of ruptured uterus was clear, and Dr. Graffagnino was summoned at once. When the bladder was catheterized in the operating room, no urine was found, only pure blood being obtained, so that it was clear that the bladder had ruptured also. Immediate laparotomy revealed a dead fetus free in the cavity, as was the placenta, a rent in the uterus on the right from cervix to fundus, and a rent in the bladder at least five inches long. What to do was a problem, since the patient had been repeatedly examined during the course of her labor, and urine had been spilled into the abdominal cavity, so that there was no doubt of infection being present. A rapid Porro hysterectomy was done,

the wound in the bladder was sutured with chromic catgut and a final layer of linen, and a Pezzer catheter was inserted. The peritoneal cavity was closed by suturing the parietal peritoneum to the peritoneum reflected on the uterus posteriorly, and a drain was left from above, extraperitoneally. Thus, if infection were inevitable, it would take place outside, since all infected parts had been treated extraperitoneally. Convalescence was without incident for three weeks. Then the bladder sloughed and a urinary fistula was evident in the abdominal wall. This gradually closed, and she has recently been discharged in excellent condition.

DR. L. A. LEDOUX inquired whether it were definitely known in what percentage of ruptures infection was a factor in the production of the condition. He cited a case of his own, recently reported, in which after a smooth recovery a rupture of the uterus developed on the tenth day, and autopsy revealed the infection to be originally intrauterine. In his opinion this illustrated the point that infection was the prime factor in reducing the strength of the operative scar, and that, when once it had set in, the method of suturing had nothing to do with the final outcome, since no type of sutures would hold together an infected and necrotic wound.

DR. GELPI, in closing, said that Dr. Graffagnino's figures, which included all types of rupture, naturally could not be compared with those he had quoted, which included only ruptures after cesarean section. The figures would naturally be much higher now, since ruptures were more frequently reported, and since the increased incidence of cesarean section naturally increased their incidence. He believed that no more appalling intraabdominal pathology could be seen than was found in this type of case, even after spontaneous rupture, and he cited an instance of spontaneous rupture in which the patient was brought in with six or eight feet of intestines protruding from the vagina, death occurring on the table before the abdomen was even opened. He had not the figures at hand to answer Dr. Ledoux's inquiry as to the part played by infection, but he believed that certain authorities insisted that infection was at the basis of every rupture, whether it was recognized or not. In his own case the patient's story of her first operation naturally led to the assumption that infection was responsible, at least for the first rupture. He believed that in his management of the case he was open to criticism on two counts. He had used but two layers of sutures, as was the custom then; since that time he had used three, though he was not sure that the additional layer did anything beyond adding to the surgeon's own peace of mind. In the second place, possibly he should have been more radical at the first operation. His excuse was that he was primarily concerned with saving the patient's life, rather than guarding her against possible uterine ruptures in the future. He could sew up a rent in the uterus faster than he could do a hysterectomy, and her condition was such that every moment of time was vital.

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## CHICAGO GYNECOLOGICAL SOCIETY

*STATED MEETING, MARCH 18, 1927*

DR. A. H. CURTIS presented a report of a case of **Pregnancy After the Menopause.**

The patient, forty-six years of age, complained of symptoms suggestive of ulcer of the stomach, great fatigue, and prostration. She was worn out, mentally and physically, and felt as though she were growing prematurely senile. She gave a history of five pregnancies, with two living, healthy children. Menstruation ceased three years before and had not returned.

Upon examination he found a tumor rising out of the pelvis to the level of the navel. This tumor, together with other evidence of a typical character, made certain a diagnosis of normal pregnancy. The x-ray picture, yielded corroborative testimony. It is rare to see pregnancy in a woman of forty-six, and still more so, a pregnancy three years after supposed menopause.

#### DISCUSSION

DR. N. H. HEANEY recalled one case of pregnancy after the climacterium had evidently been safely established. A school teacher in middle life came into the service of Dr. Webster, stating that she had the climacterium three years before. She had a cystic tumor of some size, which proved to be a pregnancy as shown by the x-ray.

DR. J. B. DELEE presented an Electric Clock which strikes every fifteen seconds. Similar clocks have been in use at the Chicago Lying-in Hospital for ten years but it has been rather difficult to popularize them because of the cost, \$175.00. This clock was invented by Dr. Wachenfeld, of Sweden. It is an ordinary Big Ben alarm clock in which there is an electric ringing apparatus. It costs about \$40.00. With the head stethoscope on, all that it is necessary to do is to wait until the bell strikes and then start to count.

#### DR. J. B. DELEE reported a case of Tubouterine Pregnancy.

The patient was in her third pregnancy. The last period occurred on December 22. Shortly after the period began she had great pain in the right side of the abdomen, which increased in severity until the time she came under observation. It was the pain that brought her to the doctor rather than the thought that she might be pregnant. Examination showed the uterus with a tumor mass in the right side, and it was diagnosed an extrauterine pregnancy by Dr. DeLee, while his associate, Dr. Horner, diagnosed the case as pregnancy in a horn. At operation they found that the woman had what was first taken to be a double uterus. The portion of the tube in the uterine wall was distended by the pregnancy, and the cavity of the uterus also formed a part of the gestation sac. The distended tube went into the uterine cavity. Its wall was so thin that one could almost see through it, showing it was not an ordinary angular pregnancy.

#### DISCUSSION

DR. A. H. CURTIS asked if Dr. DeLee meant an interstitial pregnancy. He did not see the object of dividing interstitial pregnancy into subgroups. Approximately only 100 cases have been reported.

DR. DELEE, in closing, said that an interstitial pregnancy does not extend into the cavity of the uterus. It extends outward. A tubouterine pregnancy can develop into the cavity of the uterus and terminate normally. He had had no experience with that type. In this case the cavity occupied by the ovum was composed of the tube and half the uterus. Werth and Kuestner report similar cases; it is, therefore, a proved clinical entity.

#### DR. A. H. CURTIS presented a specimen of A Malignant Corpus Luteum Tumor.

The patient, fifty-seven years old, was operated upon one week previously for a tumor which rose to the level of the umbilicus. She had bleeding during recent months, which made one think first of a malignant growth, but the bleeding was somewhat periodical and like a return of menstruation. Upon opening the tumor, Dr. Curtis found it was filled with blood. The tumor substance was of a very

decided yellow color, like a suprarenal gland or corpus luteum. Microscopic study revealed acini which simulated the structure of suprarenal tissue or corpus luteum, which look so much alike that they cannot be distinguished. He believed this to be a malignant corpus luteum tumor and that these growths are not so rare as has been believed heretofore.

This was the third tumor of this type which he had seen, one being in a girl of nine.

**DR. BARTON COOKE HIRST**, of Philadelphia, presented, by invitation, a paper entitled **Ovarian Dysfunction Dependent on Abnormalities of the Ductless Glands**. (See page 79.)

#### DISCUSSION

**DR. A. H. CURTIS** said this field of investigation was one which no single individual or group of individuals could follow out alone. It required the untiring labors of a number of men in order to accomplish anything of notable value.

He presumed every one advocated, in operations for fibroids and diseased tubes, the presentation of sufficient endometrium to assure some menstruation. But what is to be the attitude toward conservation of ovaries in those instances in which disease of the cervix necessitates complete hysterectomy? Frank has demonstrated that the ovarian hormone is present in the circulating blood prior to each menstruation and is excreted with the normal monthly flow. But in young patients who are deprived of a menstruating uterus the preservation of ovaries is followed by monthly accumulation of noxious waste products. Despite this recent evidence, Dr. Curtis' present attitude is inclined toward conservation of healthy ovaries in young women subjected to total hysterectomy.

**DR. C. W. BARRETT** asked Dr. Curtis if, in spite of the great many cases of hysterectomy with one or both ovaries removed, he would be inclined to recommend Dr. Frank's suggestion that the ovaries be removed when the uterus is removed. It seemed to him there are many clinical evidences to show that a woman is very safe and rather more comfortable with the ovaries left than with the ovaries removed.

**DR. HENRY SCHMITZ** said he had been very fortunate in obtaining standardized ovarian extract, and his observations coincided with those of the essayist.

A patient who had a full-term labor about four years ago was worried because she had not become pregnant again. Menstruation was perfectly normal though scanty. A hypofunction of the ovaries was probably the cause of the sterility. The ovarian hormone was administered subcutaneously, and within two weeks following the last menstruation and four weeks after beginning of treatment, the patient became pregnant.

Another patient, twenty-four years of age, had had a bilateral ovariectomy. Marked symptoms of a menopausal character appeared, rendering the patient an invalid. In this instance he gave the hormone and the symptoms disappeared entirely within four weeks.

He had never been able to secure similar results with the hypodermic use of any other ovarian extract.

**DR. A. H. CURTIS** said it would be interesting to know what Dr. Hirst had to tell as to the helpfulness of corpus luteum preparations which have been so much used in efforts to overcome the toxemias of pregnancy.

**DR. HIRST**, in closing, said his excuse for this rather inconclusive presentation was a desire to stimulate as many physicians as possible to try this sex hormone so that some conclusion might be arrived at. As Dr. Curtis said, the observations



of two or three physicians meant nothing. It required collective investigations. The sooner a conclusion is reached, the better for the physician and for his patients, whether it is favorable or not.

Another idea he had in mind was to awaken the clinical laboratories to the necessity of testing the blood for the presence and the amount of the sex hormone. He knew of no clinical laboratory that is prepared to do this at present, except perhaps that of Dr. Robert T. Frank at Mt. Sinai Hospital in New York. It is becoming a matter of importance. For example, suppose a young nulliparous woman or a sterile woman shows evidence of underdevelopment, and the physician wishes to know if the uterus only or the ovaries also are at fault. It would be highly important to determine the functional activity of the ovaries. If the uterus is shrunk or underdeveloped, it can be helped by electric stimulation; if the ovaries are not functioning, the sex hormone can be used in addition.

In answer to Dr. Curtis' question in reference to the sex hormone, he said why not let not only the ovaries but some endometrium remain. Howard Kelly advocated this procedure years ago. It seemed reasonable, and the speaker always endeavored to carry it out. If a complete hysterectomy is not required, he always tries to leave enough endometrium to assure the patient that she has not been mutilated. He had knowledge of three patients who are in insane asylums from brooding over their mutilation. If some endometrium is left in these patients with an ovary, the woman will menstruate perhaps scantily but enough to make her feel that her sexual life is not permanently ended.

DR. J. P. GREENHILL presented **A Human Ovum Approximately Nineteen Days Old.\***

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## Correspondence

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### Toxemia of Pregnancy, a Touch of Patience and a Grain of Sense

*To the Editor:* We have just read a spirited article written by E. M. Lazard of Los Angeles, California, entitled, "Is Magnesium Sulphate Intravenously Warranted in Eclampsia? Clinical Results vs. Experimental Evidence." (AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, June, 1927.) Previously we had been tremendously interested in Stander's work, with part of which this article deals inexorably, and had been fascinated by the paper entitled, "The Toxemias of Pregnancy and the Treatment of Eclampsia" published by J. Whitridge Williams in the *Journal of the American Medical Association*, February 12, 1927, in which the author, among other expressions of opinion, stresses the present Hopkins classification and reports a mortality of less than 2 per cent in 54 so-called mild eclamptics under the Hopkins modification of the Stroganoff treatment.

I lay no claim to be an authority on the toxemias of pregnancy, but only to a reasonable interest in the subject, which has driven me for fifteen years to see personally every case of toxemia of pregnancy possible, working in a clinic which, during this period, has cared for between 1100 and 1200 "toxemic chronic nephritic group cases." I have been chairman of a committee of the Obstetrical Section of

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\*The clinical aspects of this study appeared in *Surgery, Gynecology and Obstetrics*, October, 1927 and the histologic study of the ovum appeared in *The American Journal of Anatomy*, November, 1927.

the Massachusetts Medical Society which analyzed a small series of four hundred collected cases. In the course of these fifteen years, not counting odds and ends of carefully studied personal material, I have studied three series of approximately four hundred cases each in some detail.

To show the spirit in which the following comment is made I will quote myself in a talk on toxemia made recently in Williamstown, Mass. I said in substance commenting on Stander's and William's work, "Though there are many points in their work on which we must for the present disagree, none the less this subject of toxemia has us all so baffled and at a standstill that we cannot afford to be in anywise acrimonious or dubious among ourselves. We must accept and analyze with great care and fairness the work of all sincere students of that most fascinating and little understood problem of obstetrics."

In the light of my own experience and study, for example, no statement could be more ridiculous and more arbitrary at first sight than that preeclampsia represents only 5 per cent of the toxemic chronic nephritic group cases because, in our three series of four hundred cases each, the first showed 25 per cent convulsive toxemias, the second showed 50 per cent convulsive toxemias, and the last series of similar number showed 8 per cent of convulsive toxemias. Since this high proportion of these twelve hundred cases had eclampsia, we must agree that they had preeclampsia; yet on closer analysis it may well be that hospitalization in these groups only took place in such severe toxemias that this percentage of convulsive toxemias supervened and on this reasoning that Standers and Williams are right.

Again Lazard's detailed cases in his last article in which he attributes the delivery of a live child to the use of magnesium sulphate over rather prolonged periods in four cases, mostly chronic nephritics, is totally unconvincing to us. In a study we made four or five years ago under title, *Recurrent Toxemia of Pregnancy*, cases of this sort with this outcome repeatedly occurred, and this long before we ever used a dose of magnesium sulphate intravenously or intramuscularly. Yet here again further thought may make this use of the drug more convincing in this respect.

Our own small experience with magnesium sulphate intravenously (perhaps in 150 or 200 cases) has seemed to show that in the true toxemias of pregnancy it did lower blood pressure to a useful extent, but that in chronic nephritics the blood pressure dropped only temporarily or not at all. This to such a degree that we have felt that it was almost a sure diagnostic differentiation in doubtful cases.

Further, there is no question but that Stander's and William's point of view about "low reserve kidney" and their explanation thereof leaves us colder than any other detail of toxemia which has ever been presented. The Eden division of eclampsia into severe and mild is the next most unreasonable proposition we have met. At first glance, as we have seen eclamptics, they were all severe, and once fits have occurred, we have been unable to make a satisfactory prognosis and doubt very much if others can make a better one than ours. Everything in our experience makes us feel that the only way we could classify eclampsia as severe or mild would be after each patient died or got well, by which time it is of little therapeutic importance. Yet here again we may be wrong; the term "low reserve kidney" may really mean something, and the Eden classification may give us a divisional grouping for better treatment. One explanation of our divergent views occurs. Perhaps there are geographic differences of eclampsia. Perhaps on this basis we do not see "Russian eclampsia" or "Baltimore eclampsia" or even "Los Angeles eclampsia." Another thought, perhaps in other places convulsions are allowed to develop in cases under care because of a more conservative point of view about interference than we hold, and since there has been time to study these cases a more accurate division into severe and mild may be truly made.

For years with my colleagues, in my teaching, and above all in my own thinking

to myself on obstetric subjects, I have urged one point of view, namely, that we should differentiate the things that we think we know from the things we actually know. To think with Lazard that a single drug will influence the known progression of nephritis in pregnancy or the known irregularity of these progressions, or to think, once having seen at autopsy a dead eclamptic, that you can stop the definite progress of the disease without removing the cause, is to admit to an unbiased observer that too great enthusiasm to partial results have been aroused in an individual.

So much for the healthy scepticism of a person who feels that it is more profitable to attempt to reconcile our ideas than to disagree.

Now let us take the other outlook. The work of Stander in relation to the placental exchange of fats, in relation to the acidotic group of eclamptics and deoxygenation, in relation to the  $\text{CO}_2$  combining power of the blood in these cases, and with morphia, is splendid work. His work on all inhalation anesthetics in their production of eclamptic-like lesions (and this leads toward delivery of eclamptics under some form of local anesthesia) is, I believe, the most splendid single scientific contribution to this subject which has been made, and checks well with our own clinical observation.

Lee Dorsett's wonderful series of eclamptics treated only with magnesium sulphate intramuscularly together with the work of Lazard and others have shown at least that magnesium sulphate is nearly always a controller of eclamptic convulsions and that is all that it has shown and that is of great importance.

Williams' and Stander's classification even if not final is a great step in the right direction and is based on sound, painstaking scientific work which is more than may be said for any previous classification.

The use of large amounts of fluids, and glucose and insulin in the acidotic group, and perhaps concentrated glucose intravenously in the anuric group, are sound assets.

The discovery of blood chemistry and its application is in the end an answer to the etiology. Finally, the abandonment of divulsion of the cervix and delivery, so that now at least by the Stroganoff method and its modifications we allow such eclamptics as are destined to live, to live, is a wonderful advance.

These are all results of the work and thought of the last few years. We are getting together a real armamentarium, and the cyclic treatment of toxemia is over.

The thought is this. Let us accept the little bit of truth each of us brings. Let us try to reconcile our views and not acrimoniously debate detail. Let us above all not intensify the old fashioned difference of viewpoint of the clinician and the worker in the laboratory—each has much to learn from the other. Only by co-operation and some overlapping in knowledge can our toxemic problem be settled. I have always been a straight clinician, and yet the work of Stander and contact with the biologic chemist of our own hospital has in the last two years given me a knowledge and a command of clinical possibilities in toxemia never before possessed and never possessable by any amount of straight clinical observation.

Toxemia now is the obstetrician's unconquerable enemy in spite of all optimism. Fifty per cent was the maternal mortality in the Massachusetts series mostly done by obstetricians of merit in hospitals of excellent sort. None of the obstetric professors who cry that they have not enough cases of eclampsia to teach their students have yet a leg to stand on except that the hope is the father of the thought.

In conclusion then, I know, on the basis of the experience cited above, one thing about eclampsia and that is this: I know that in two parallel series of four hundred cases each of the "toxemic chronic nephritic group," we had in the first a mortality of 25 per cent in the convulsive toxemias, and we had in the second, partially under Stroganoff's method and magnesium sulphate treatment,

a mortality of 24 per cent in convulsive toxemias, practically the same. In the first series we had 25 per cent of convulsive toxemias and in our second series of equal size 8 per cent of convulsive toxemias, and that, therefore, by count in a series of four hundred women in this group we saved thirty actual lives by interfering earlier before convulsions than in the first series. By this result I feel justified in stating that until somebody demonstrates the cause of toxemia of pregnancy and the definite therapeutic means of removing this cause, that since eclampsia occurs only in pregnant women, interference with pregnancy prior to convulsions is the main therapeutic agent at our command, and we urge that until this happy result has been obtained by laboratory methods, which surely is the manner in which it will be obtained, we should adhere to this sound clinical principle and should not be led astray, especially by the report of a small series of clinical results with the use of any single therapeutic agent.

The conquest of the toxemia of pregnancy depends primarily on a universal acceptance in this country of some index, of some classification, some cooperative mode of study in every great obstetric center—Baltimore, Los Angeles, St. Louis, Ann Arbor, Chicago, Philadelphia, New York, Boston, and all the rest of our obstetric units. This is not an idealization. Tangibly it means this. We urge strongly that a committee of representatives of the great obstetric societies of the country meet with a view to establishing a working index and classification, tentative at first and changeable at each yearly meeting. It is only in this manner, with the cooperative spirit of the best obstetricians of this country, with the personal exchange of ideas, that we can take advantage of blood chemistry and the other scientific laboratory knowledge and finally, after some years of understanding and helpful effort accomplish the result. I urge this on all specialists in obstetrics in the United States and Canada as a most obvious and reasonable basis for real results.

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*To the Editor:*

Dr. Edgar F. Schmitz has published in the *AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY* (xiii, No. 6), a paper about a very interesting case of endometrioma in the ovary and inguinal canal. He gives a new theory for the explanation of these parts of the ectopic endometrial tissue, which grow outside of the abdominal cavity and are, therefore, not to be explained by Sampson's implantation theory. He suggests that the glands of these parts of the endometrioma are derived from metaplasia of the endothelial cells which line the finer capillaries and lymphatics. Fig. 7 illustrates this metaplastic transformation.

I published a paper entitled "*zur Frage des ektopischen Endometriums*" ("The Question of the Ectopic Endometrium") in the *Archiv für Gynäkologie* (vol. cxxvii), in which I gave the theory of the metaplastic or prosoplastic transformation of the endothelial lining of lymph spaces into columnar epithelium which leads to the transformation of the lymph spaces into glands of endometrial type or into ectopic pseudoendometrium (pages 587 and 607). This is illustrated by some figures of which especially No. 23 harmonizes with Fig. 7 of the article by Dr. Schmitz.

For the preservation of my priority, I want to state that my paper was finished in August, 1925.

VIENNA, Aug. 16, 1927.

WALTER SCHILLER, M.D.



in instructing medical officers at the training camps. I personally was at one of these camps for five months, during which time the newest information received on medical subjects dated from the Civil War, except for lectures delivered by other inmates of the camp whose ignorance of modern problems was as abysmal as my own. Only one *line* officer of the Canadian forces talked to us on conditions in the trenches.

Selection of a few of the most important items is difficult because of the wealth of material dealt with. Casual officers assigned to the British were hard to keep track of. We constantly averaged 800 officers, 600 nurses and 1,100 enlisted men with the English service. A certain degree of uncertainty as to the exact location of men, officers, nurses and enlisted men in our own expeditionary forces is acknowledged. This was due to many causes and resulted, as I personally can vouch for, in confusion and individual hardship. By January 11, 1919, 17,767 medical officers, 9,994 nurses and 145,815 enlisted men comprised the Medical Corps of the American Expeditionary Forces, a total of 173,576.

The machinery of promotion, as we all were well aware of, presented unexpected difficulties, and proved most unequal. This applied particularly to those assigned to the British Forces. Very few promotions were made in the American Expeditionary Forces in the first ten months of service, and few after November, 1918.

Lack of space prevents me from discussing the dental and nurses' service.

Many pages are devoted to the laboratory service and that of infectious diseases, as well as epidemiology. Description of construction and administration of base hospitals is gone into in great detail. One hospital center is likewise described at length. The field and mobile hospitals, our hospital trains, are also discussed, but evacuation hospitals are dealt with in another volume.

The autopsy service was found very insufficient, largely for lack of trained pathologists, as many of the bacteriologists were needed for the study of infectious diseases, wound bacteriology, water examination, etc. By June, 1918, permission for preparing beds for 15 per cent of the A. E. F. had finally been accorded.

Some confusion resulted from the appointment of "directors" of professional services. These were not informed of either their powers or the limitation of their field. Eventually, x-ray, orthopedic, eye service, neurologic service, and surgical teams were established. These surgical teams supposedly consisted of an operating surgeon, an assistant, an anesthetist, two nurses, and two corpsmen. My own surgical team functioned with a single nurse borrowed at random whenever possible, although, finally, one week after the armistice had been declared, a single nurse was assigned to me. The two corpsmen assigned to me for five months' service in the evacuation hospital, doubtless were efficient truck drivers in Detroit (their pre-war occupation), but proved a liability instead of an asset as assistants, mainly keeping me occupied in trying to prevent them from being A. W. O. L. and out of the clutches of the court martial, which I actually succeeded in doing until after the armistice was declared.

The maxillofacial service was greatly handicapped by lack of equipment. The venereal and skin service treated a large number.

The medical service had to deal with tuberculosis, psychiatric cases, communicable diseases and gas poisoning.

The medical supply service had a huge task to accomplish in the face of tremendous difficulties.

Over 262,000 personnel of all branches formed the American force in Germany by January, 1919. Here the Medical Department had to contend particularly with the diseases suffered by the civil population, especially influenza, typhoid, and diphtheria. The sudden influx of troops doubled the number of local inhabitants in the occupied area and grave emergencies arose before it was possible to adequately control the water supply and disposal of waste. The infestation by lice likewise proved a difficult problem to contend with.

Volume XI deals with general surgery, orthopedics, and neurosurgery. It was hoped to be able to obtain the final results in peripheral nerve injuries but this very valuable study had to be abandoned because of the rapid dispersion and amalgamation into the civil population.

The surgeons in the great war were confronted with an entirely new problem due to the new pointed rifle missile which produced an area of devitalized tissue throughout its course. This new problem was met by the allies long before our entry into the war by the procedure of débridement, which consisted of excision of the surrounding injured area, followed by primary or secondary suture. The treatment of shock was greatly improved by transfusion and heating of those patients whose temperatures were subnormal. My own personal experience and that of others in evacuation hospitals showed that the gum salt solution was of no value and, in fact, in many cases, did actual harm.

The war showed the importance and value of armor, especially of helmets. Some interesting chapters on artillery and small arms are found in Volume XI.

The briefest summary of casualties is of interest. Of lacerated wounds, 46,549; penetrating wounds, 42,374; fractures, 25,272; total injuries sustained in battle, 153,537. Death from wounds received in battle, exclusive of deaths on the field, amounted to 12,470. The number of discharged for disability resulting from battle injuries were 22,330. Incomplete statistics going to July 11, 1921, show the tremendous number of over fourteen and one-half million days lost in hospitals.

Surgery at the front includes the treatment of wounds on the field and in the various hospitals of the advanced area. In the American Army no preferential treatment was accorded to the lightly wounded but it was found that many of these could be evacuated to the rear areas without incurring undue danger from infection by the gas-forming bacilli. Consequently our evacuation hospitals dealt especially with the more severely wounded whom it was not deemed advisable to send unoperated to the rear. I can personally vouch for the fact that during the rushes we frequently evacuated the recently operated patients before they were quite out of their anesthetic. In the hospital with which I was connected during the Chateau Thierry offensive, we evacuated continuously for days and regularly as often as three times in twenty-four hours. This condition is also mentioned in the text.

The conference on problems relating to the area of advance in

Chapter V, giving a discussion by many of the consultants, is most interesting. The same applies to the answers to the questionnaires, although the opinions advanced by no means settle these questions finally. The question as to "in what cases gas and oxygen is especially indicated?" appears rather amusing when I recall that during five months in an evacuation hospital I never saw a cylinder of nitrous oxide. In this questionnaire the gum salt solution, previously referred to, did not receive favorable comment.

Anesthesia, wound shock, localization and extraction of foreign bodies under x-ray control are all of interest. In reference to the last I wish to put in an additional word of praise for the extreme, unselfish devotion which a large number of x-ray men showed throughout the tremendously long and trying hours of their daily work. The wonderful accuracy with which they localized innumerable foreign bodies, often multiple in the same patient proved admirable, so that if the body was not found at the place indicated, we felt the fault was more often ours than that of the radiologist. Considerable space is devoted to the dreaded gas gangrene. Tetanus, because of routine prophylactic injections, proved a negligible factor by the time that our armies entered the zone of activity, only 36 cases being reported, a rate of 0.014 per thousand. Chapter XII deals with wounds of the soft parts, especially with débridement. The next chapter takes up joints. After this, wounds of the chest, abdomen, genitourinary tract, and long bones are discussed.

Section 2 of Volume XI deals with orthopedic surgery, covering all portions of this field, including appliances and treatment of amputation stumps. The final section of this volume deals with neurosurgery, which does not lend itself to review but contains a tremendous amount of valuable information.

Four contributions from the Division of Medical Education of the Rockefeller Foundation have come to hand, dating from the year 1924 to 1927. They deal with *Methods and Problems of Medical Education*.<sup>2</sup> The publications give brief descriptions of clinics, laboratories and methods of teaching in different parts of the world, with the aim of assisting those who are planning improvements in building and methods.

Such varied subjects as the sanitary survey as an instrument of instruction in medical schools (Milton J. Rosenau), as well as a sanitary survey of Rochester, New Hampshire (S. Warren), are contained in the second series. The fifth series contains many contributions from Washington University, St. Louis, covering the departments of anatomy, pathology, bacteriology and public health as well as physiology. McGill University, Montreal, has descriptions of some of these same departments, as well as those of botany, zoology, biochemistry, pharmacology and the O. P. D. Numerous other contributions from as diverse regions as Soochow, China; Utrecht, Netherlands; and Montpellier, France, are included.

Series 6 is equally international. Among others, articles from Peking, China; London, England; Dublin, Ireland; Milan, Italy, etc., have been incorporated. The subjects dealt with are departments,

<sup>2</sup>*Methods and Problems of Medical Education*. Second series, 1924; fifth series, 1926; sixth series, 1927; seventh series, 1927. Division of Medical Education, The Rockefeller Foundation, New York.



buildings, equipment, and even details of teaching, as those of percussion in Vienna and visual instruction in Germany.

The final series published (No. 7, 1927) deals entirely with the new medical school in Rochester, New York.

These contributions cover so many subjects that they do not lend themselves to review. Anyone planning to change and improve a medical school cannot fail to obtain a tremendous amount of valuable information from their pages.

*The New Medical Follies* by Morris Fishbein, editor of the *Journal of the American Medical Association*,<sup>3</sup> is a cleverly written, caustic, striking, fearless exposition of the many medical cults and foibles which exist, especially in our country. The treatment is somewhat journalistic, which is explained by the fact that many of these essays have appeared in lay journals as well as in medical publications. The author brings out that the cults scrupulously avoid all the fundamental sciences. In alphabetic arrangement he gives a short but complete survey of all the cults, beginning with "aerotherapy" and ending with "zonotherapy." This will be of use as ready reference to those who wish to look up some particular cult. He then takes up beauty parlors, the beauticians and cosmetologists, etc., who occupy at least 2000 "Shoppes" in New York City. Next to be roasted are the licensed advertising plastic surgeons and the reduction and dietary fads. Rejuvenation can be summed up by the aphorism, "There is no fool like an old fool." Such outstanding figures as Steinach, Benjamin, and Voronoff are pilloried. The autointoxicationists, at the head of whom is Arbuthnott Lane, do not escape. A separate chapter is devoted to the rise and fall of eclecticism and, in conclusion, Fishbein "pans" the exaggerated tendencies of the psychoanalysts whom he includes in the cultist movements. The book is well worth reading and contains many unvarnished truths.

#### GYNECOLOGY

*Biologie und Pathologie des Weibes*,<sup>4</sup> edited by Halban and Seitz, is slowly approaching its completion. Of the eight volumes, nearly seven and one-half are completed, leaving only one and one-half volumes to be published in the near future.

Installment 34 contains four different subjects. Sigwart here concludes his pathology of the puerperium. As the literature is so tremendous, he has attempted to sift the material, giving the views with which he is personally most familiar. The treatment of puerperal sepsis he divides into local and general. As a routine in the presence of infection he lays open all perineal and vaginal wounds. He is strongly opposed to intrauterine irrigation, which is both dangerous and useless. He fears digital exploration of the uterine cavity even more. On the other hand, he believes in early serotherapy, using 100 c.c. of Hoechst's antistreptococcus serum, 50 c.c. the first day and as much the second day, injected in the gluteal region. If necessary he repeats these injections after five or six days, taking due precautions against possible anaphylaxis. The serum is polyvalent and

<sup>3</sup>The *New Medical Follies*. By Morris Fishbein, M.D., Editor of the *Journal of the American Medical Ass'n* and of *Hygeia*. Boni and Liveright, New York, 1927.

<sup>4</sup>*Biologie und Pathologie des Weibes*. Nos. 34, 35, 36, 37, 38, and 39. Edited by Halban and Seitz. Urban and Schwarzenberg, Berlin, 1927.

according to his experiences, of considerable value. He has also used rivanol intravenously with occasionally gratifying results. He is in favor of tying infected veins in cases of chronic thrombophlebitis. According to the literature quoted, 50 per cent of the patients recover. In puerperal peritonitis he inserts multiple drainage tubes and leaves ether in the peritoneal cavity before closure.

Freund discusses rupture of the uterus. Hammerschlag deals with trauma and operations during pregnancy, including external traumata, the effect of radium and x-ray. Sudden death in pregnancy, in labor and in the puerperium is described by Knauer.

Installment 35 contains an article by Guggisberg on the complications of pregnancy, labor and the puerperium due to disturbances resulting from the soft parts. Statistics show that very young primiparae have a shorter labor, less morbidity and mortality, and fewer tears than older ones. He considers that this applies up to the age of twenty-five years. In older women there is an increase in the duration of labor, weak pains are more frequent, and operative interventions are more often called for.

The same installment contains the beginning of the article on hydatid mole and malignant chorioepithelioma by Hitschmann. No new light has been thrown on the etiology of malignant chorioepithelioma up to the present day. He reviews all the older and modern theories. At present over 1000 cases are on record. He accepts no morphologic criteria as of value in forming a prognosis. If no metastases have occurred within the first two years after operation, the case may be considered cured. The extensive literature still confirms the present view of the great variability in malignancy of this type of tumor, some cases showing a benign course, others a regression after incomplete removal, still others proving rapidly fatal.

Installment 36 contains an extremely important and up-to-date monograph by Latzko and Schiffmann on the diseases of the genitourinary tract in the female and its relations to the female genital organs. The authors speak of Stoekel and Kolischer as the founders of gynecologic urology, apparently forgetting the many fundamental contributions of Howard Kelly. They condemn the use of the Pawlik-Kelly technic entirely, comparing the use of this technic to a hobby-horse in comparison to a live steed. Here again they forget that before the Nitze technic had been developed we were compelled, in default of other, to use endoscopic methods and that even today occasions arise when this simple and direct technic is of great aid.

They prefer indigocarmine to phenolsulphonephthalein for determining the excretory power of the kidney. They agree that the Ambard constant is not reliable, and they accord no value to the phloridzin method. They warn us that carcinoma of the urethra sometimes masks under the guise of an innocent caruncle. Although many methods are described, Coffey's method of implanting the ureters into the lower portion of the large bowel is favored above all others in the treatment of extrophy of the bladder. They see no difference between "the elusive ulcer" of Hunner and simple ulcer of the bladder. Furthermore they do not accept a metastatic origin of ureter stricture, resulting from tonsils and other distant sites of infection. They believe that the constant finding of ureter strictures is really due to local and transitory spasm. Little value is ascribed to neph-

ropexy. This monograph is carefully prepared, is well condensed, conservative, takes due consideration of the literature and may generally be summed up as sound and sane.

Installment 37 contains a short chapter on asepsis, including the preparation for labor and for operative interventions by Stickel. The author prefers ether. The chapter is short and colorless.

The next two treatises cover the physiology and pathology of the newborn, Reuss giving a short and comprehensive description, illustrated by many beautifully colored plates, as well as by numerous photographs.

Installment 38 deals with the biology and pathology of pregnancy and labor in domestic mammals. The contents will be of interest not only to obstetricians and gynecologists but also to biologists and investigators. Keller, among other topics, takes up the duration of pregnancy in various species, and their number of young. The methods of diagnosing pregnancy in animals is gone into, varying from abdominal examination in the smaller mammals, as well as the changes in the genitals and breasts, to vaginal and rectal palpation in the larger types, such as the cow and the mare. As in human medicine, biologic methods of diagnosing pregnancy have proved of no practical value, although many are instanced.

Much of interest is found in the description of labor and the puerperium, and in the various methods which animals employ or nature has devised in severing the cord postpartum. Umbilical infections are apparently not uncommon in animals and therefore are of economic importance. Vaginal prolapse occurs in a number of forms, particularly in the cow, mare and sheep. Extrauterine pregnancy is almost unknown and, on the whole, appears never to have been convincingly demonstrated except in the human being. Bacterial abortion is frequent. The author apparently agrees with some of our American veterinary obstetricians who believe that many other organisms besides the bacillus abortus of Bang are at fault. Distocia is taken up in detail as well as operative obstetrics.

Installment 39 deals with two aspects of carcinoma of the cervix. Kermauner describes the clinical aspects and operative treatment of carcinoma of the uterus. In conformity with other authors he divides the subject into corpus and cervix carcinomas, but acknowledges that in advanced conditions the original point of the origin cannot be determined. He sees no reason for further subdivision into portio and canal tumors. The etiology is as unclear as ever, such conditions as psychical state, race and social condition playing no definite rôle. Any etiologic value ascribed to these rests merely on the general impressions of various authors. The description, in many ways, follows that of the well-known book by Schottländer and Kermauner. Statistics show no increase of growth or increased malignancy during pregnancy. Much importance is ascribed to diagnostic excisions. No value is attached to a so-called malignancy index, the histology not aiding in predicting the future course. The many statistics are so confusing that they prove un-understandable to me. In operation he prefers the abdominal route. Apparently he subjects all cases in which the technical difficulties are not too great, to operative surgery.

Eymer, on the other hand, describes radium and x-ray treatment of

carcinoma of the cervix. The results with corpus carcinoma have been very poor. However, those with cervical carcinoma are encouraging, thus further justifying the stand of those of us who have abandoned the Wertheim operation in cancer of the cervix in favor of combined radio and x-ray therapy.

C. Jeff Miller has written a short *Outline of Gynecology for Students*<sup>5</sup> which deserves wider publicity than its modest format and its limited scope of circulation give to it. Based on his experience as a teacher, Miller has felt that the overburdened and overworked medical student deserves a carefully worked out but short exposition, which avoids the faults of the so-called syllabus and yet saves the student from wading through the many diffuse pages of the average textbook. The entire subject of gynecology is covered in a compass of 268 pages. This enables the third year student to actually study this text with some likelihood of remembering what he has read.

R. Franz has published a textbook for students and physicians on *Gonorrhea in the Female*.<sup>6</sup> This is a very comprehensive, short book, well planned out and covering the field most completely. The main objection to the text is that the author has not emphasized sufficiently those methods which have given him the best results and presents all the current methods of treatment without sufficient comment. Any one with experience will find it a most useful reference book, as every detail is carefully gone into. The culture methods recommended are not at all up to modern standards. The use of intrauterine injections is featured in the text, but the extreme dangers of this method are not sufficiently emphasized. The conservatism recommended during the acute stage of the disease or in the presence of peritoneal irritation is to be highly endorsed. On the whole Franz's is one of the most useful small textbooks on this subject existing in any language.

*L'examen Médical en vue du Mariage*<sup>7</sup> consists of a series of articles published under the auspices of the French Society of Eugenics with the aim of clarifying the opinion and knowledge of the public on the actual conditions of affairs. The ultimate aim is to modify the French marriage laws so as to have compulsory examination before marriage incorporated in them. Numerous well-known medical men and laymen have contributed. Legislation in the United States is freely quoted and every aspect of the subject discussed in detail, such as the general eugenic question, tuberculosis, venereal diseases, mental, and nervous diseases. It is encouraging that a strong movement dealing with this burning question is under way in various countries.

Evans, Burr, and Althausen have published a most thorough monograph on the *Antisterility Vitamine Fat Soluble E*<sup>8</sup> appearing in the *Memoirs of the University of California*, Volume VIII. This is a

<sup>5</sup>An Outline of Gynecology for Students. By C. Jeff Miller. Tulane University, New Orleans.

<sup>6</sup>Die Gonorrhoe des Weibes. Ein Lehrbuch fuer Aerzte und Studierende. By Dr. R. Franz. Verlag von Julius Springer, Wien, 1927.

<sup>7</sup>L'examen Medical en vue du Mariage. Ernest Flammarion, Editeur, Paris, 1927.

<sup>8</sup>The Antisterility Vitamine Fat Soluble E. By H. M. Evans and G. O. Burr. Memoirs of the University of California, Volume VIII. University of California Press, 1927.

worthy successor to Volume VI to which one of the authors (Long and Evans) contributed work on the Estrous Cycle in the Rat. The present monograph is based on an almost incredible amount of study and investigation.

The conclusion reached is that there is a substance present in the active fraction which is specific for curing a specific type of sterility induced by certain purified diets. "The cure has repeatedly been effected by as little as 5 mg. of concentrated fractions fed on the day of positive mating." Controls have never given litters. The vitamine appears to be a fat soluble material, biologically active and thermostabile. The authors compare the vitamine in many of its characteristics with the female sex hormone.

Sellheim<sup>9</sup> has written a short pamphlet on the treatment of sterility which appeared in the *Abhandlungen aus der Geburtshilfe und Gynäkologie und ihren Grenzgebieten*. Of the general causes he emphasizes sperma immunity, coitus abortus, previous appendicitis, as well as the regularly blamed conditions, such as sterility of the husband and impermeability of the tubes. He uses salpingography to determine the site of the stricture if present. He advises curettage in case of oldish patients recently married, as well as in patients who have used anticonceptional measures for a long time, without giving convincing reasons for this therapy. The monograph concludes with a description of numerous complicated technics for tubal implantation.

The second edition of Young's *Textbook of Gynecology*<sup>10</sup> (Edinburgh Medical Series) forms a short book for students. The text is concise, clear, and on the whole adequate and up to date. The illustrations are numerous, somewhat diagrammatic and in many instances the same cuts are repeated in different connections. The three types of pessaries advised (the spring core ring, the shelf pessary—a modified Zwank—and the cup and stem) are the very ones which I have found least useful and most dangerous.

Fischer's short monograph on the *Gynecology of Dioskurides and Plinius*<sup>11</sup> will prove of interest to the student of the history of medicine. Obstetrics is also discussed.

#### OBSTETRICS

Prof. George Winter has published an operative obstetrics,<sup>12</sup> the main portion of the text having appeared in Halban and Seitz's *Biology and Pathology of Women*. As this huge series of monographs is inaccessible to the average student and practitioner, he has thought it worth while to revise the text for their benefit and have it appear in the form of a single volume. Prof. Winter is ably assisted in his task by Benthin and Naujoks, who have written several of the chapters.

<sup>9</sup>Weitere Fortschritte der Sterilitätsbehandlung. By Hugo Sellheim. Verlag von S. Karger, Berlin, 1927.

<sup>10</sup>A Textbook of Gynecology. By James Young. Ed. 2. Macmillan Co., New York, 1927.

<sup>11</sup>Die Gynäkologie bei Dioskurides und Plinius. By I. Fischer. Julius Springer, Wien., 1927.

<sup>12</sup>Lehrbuch der operativen Geburtshilfe fuer Aerzte und Studierende. By Prof. Dr. Georg Winter. Urban and Schwarzenberg, Berlin, 1927.

Spinal anesthesia has been abandoned as being too dangerous. As is usual in Europe, the authors prefer chloroform for the induction of narcosis but, if prolonged anesthesia is necessary, switch over to ether. An extremely conservative attitude is observed toward the induction of abortion in the face of medical and other indications. The authors say that both for ethical and legal reasons the induction of abortion, from the eugenic standpoint, is not permissible. The eugenicists, and here I feel that most medical men agree, believe that retinitis pigmentosa, amaurotic idiocy, dementia precox, genuine epilepsy, Huntington's chorea, maniac depressive insanity, degenerative hysteria, Pelizans-Merzbach disease, should really be accepted as indications. I notice with surprise that laminaria tents for dilatation are still recommended. Winter considers vaginal cesarean a valuable method but I note that in twenty years only 56 cases were treated by this technic at his clinic. Hebstectomy is still practiced although from 3 to 10 per cent of bladder injuries occur. The Kielland forceps has been found useful with the head high up. This is a very complete and well-written textbook throughout, which, on the whole, conforms fairly closely with our American procedures.

Two monographs by Vignes<sup>13</sup> and Bach<sup>14</sup> are extracts from *Traité de Physiologie Normale et Pathologique*. The first, by Vignes alone, deals with the genital apparatus of the woman. It is encyclopedic in scope, exhaustive in treatment, with a minute scrutiny of the literature. References which I have been looking for in vain for years, I at last come across as footnotes. The subjects covered are the principal functions of the genital tract, including the menstrual cycle, the associated tracts and the effect of menstruation upon them, the theory of menstruation, the physiology of sex, and finally, deviations from the normal. This is a most valuable contribution because of its exhaustive treatment of the subject, its short compass, and its reference to original sources.

The second monograph in collaboration with E. Bach deals with the pregnant woman, pregnancy, embryo, fetus, and placenta. These subjects have been treated in an identical manner with equally happy results. Both monographs can be used as reliable sources of reference.

Heidler and Steinhardt have treated the subject of manual removal of the placenta.<sup>15</sup> Their material comprises 1000 cases obtained from a total material of 64,000 cases or 1.56 per cent. The general mortality is high, being 8.2 per cent throughout this period which covers twenty-one years. Two and eight-tenths per cent died of hemorrhage and 1 per cent of sepsis, the remaining being ascribable in most instances to the underlying diseases rather than to the method employed in delivering the placenta. The morbidity was 29.52 per cent altogether. I cannot refrain from forming the impression that, in conservative hands, manual removal of the placenta will always remain a rare intervention, because waiting so regularly proves suc-

<sup>13</sup>L'Appareil Genital Femelle. By H. Vignes.

<sup>14</sup>La Femme Enceinte. La Gestation. L'Embryon et le Foetus. Le Placenta. Extrait du Traité de Physiologie Normale et Pathologique. By H. Vignes et E. Bach. Publié sous la direction du Pr. G.-H. Roger. Secrétaire Général: Léon Binet. Vol. xi. Masson et Cie, 1927.

<sup>15</sup>Ueber die Manuelle Plazentaloesung. By Dr. H. Heidler and Dr. B. Steinhardt, von Curt Kabitzsch, Leipzig, 1927.

cessful, and because every effort should be made to keep out of the uterus in view of the danger of the procedure.

Ford, Crothers, and Putnam's book<sup>16</sup> is a part of a series of *Medicine Monographs*, each of them representing a comprehensive critical review of some important medical problem. Undeniably the question of injury of the child during birth is one of outstanding interest. Discussed in all its many aspects a few years ago by Ehrenfest, we find here a more detailed consideration solely of birth trauma of the central nervous system. Ford deals in the first part of the volume with cerebral injuries. After quoting the more or less known and accepted views concerning etiology and pathology, he discusses critically the intricate but yet most significant relation of such injuries to physical and mental development in later life. Most valuable excerpts of clinical histories are presented. The final conclusions drawn from this study are laudably conservative, at least in comparison with the noticeable trend of some recent writers, to ascribe almost all later deficiencies to cerebral birth traumatism.

In similar manner Crothers and Putnam in the second part of the volume deal with the injuries of the spinal cord. They fully confirm the view previously expressed by obstetricians that undue traction plays the significant etiologic rôle. Much of this knowledge we owe to the original investigations of Crothers. They come to the definite conclusion that traction on the spinal cord during birth produces cord injuries which represent a very important cause of physical disabilities noted in children.

Six authors have combined to write *The Queen Charlotte's Practice of Obstetrics*.<sup>17</sup> This volume was written to set forth the views held and the methods practiced by those at present connected with the staff of this hospital. The hospital is the earliest lying-in hospital in Britain. It has moved several times since its foundation and at present is apparently housed under modern conditions. From 1900 to the present time, approximately 1800 women were delivered in the hospital and 2100 in their homes each year.

The subjects covered are the usual ones, namely, development and anatomy, normal and abnormal pregnancy, labor and puerperium. There follow sections on the baby, on obstetric operations and the concluding section on miscellaneous subjects which embrace such varied topics as insanity, pituitary extract, anesthesia, x-ray, vaccination and statistics covering Great Britain and continental Europe, maternal and fetal mortality. On the whole the volume does not make an exceptionally favorable impression. A fairly active interference in abortion, including curettage if the products of conception are not expelled within twelve hours, does not conform with modern American practice. In the treatment of vomiting and toxemia of pregnancy no mention is made of the modern method of giving glucose by rectum or vein, or the treatment by glucose and insulin combined. In eclampsia no mention of the Stroganoff method is made.

<sup>16</sup>*Birth Injuries of the Central Nervous System.* By Frank Ford Bronson Crothers, and Marian C. Putnam. The Williams and Wilkins Co., Baltimore, 1927.

<sup>17</sup>*The Queen Charlotte's Practice of Obstetrics.* By J. B. Banister, A. W. Bourne, T. B. Davies, L. C. Rivett, L. G. Phillips, and C. S. Lane-Roberts. Wm. Wood and Co., New York, 1927.

On the whole this book has little to recommend it although it is well gotten up and adequately illustrated.

Kupferberg<sup>18</sup> has edited live topics in obstetrics appearing in the series of the *Kleine Klinische Bücherei*, No. 25. Because of the marked reduction of the birth rate, he emphasizes the necessity of conserving both maternal and fetal life and health, dealing exclusively with serious complications. Most of these articles have appeared previously either in *Medizinische Klinik* or *Der Praktische Arzt*. Such subjects as amelioration of pain during labor, oxytoxics, and drugs favoring uterine contraction, conduct of labor without vaginal examination, etc., are dealt with.

The third edition of Maygrier and Schwaab's *Précis d'Obstétrique*<sup>19</sup> is a thick volume of over 1200 pages, which deals with the subject in the accepted fashion. The illustrations which depict obstetric procedures with the ungloved hand, and occasionally with starched cuffs unremoved, are, I confess, somewhat disturbing.

#### ENDOCRINOLOGY

A number of installments of the *Handbuch der Inneren Sekretion*<sup>20</sup> have been received. They are issued irrespective of their sequence, which can be done without disturbance because of the fact that each contribution represents a separate monograph.

Volume I, Installment 3, by Berberich and Fischer-Wasels, deals with the thyroid and internal secretions. The authors point out that the thyroid, parathyroid, and thymus are all three of branchial derivation. The thyroid gland undergoes transitory and usually symptomless changes in acute and chronic infections. In the latter class of cases, symptoms may, however, develop. Physiologically the thyroid appears to increase at the time of puberty, premenstrually, and in pregnancy. If the thyroid is absent or diseased, the chief cells of the hypophysis increase, as well as the colloid they store. The connective tissue of the hypophysis likewise increases under these conditions and dilatation of the capillaries may occur. Being of conservative trend, the authors refuse to commit themselves as to whether these two glands of secretion are antagonists or synergists. In all the so-called pluriglandular syndromes, the thyroid is also affected. The effect of thyroid changes on the skin, muscle, bone and nervous systems are discussed in detail.

The division of struma into the nodular and diffuse type is accepted, but many transitional forms occur. Struma diffusa parenchymatosa most often is accompanied by Basedow symptoms. This change is rarely found without the occurrence of exophthalmic goiter. Most characteristic is the increase in size of the cells of the follicle epithelium, the colloid contents of the acini being diminished, and the colloid appearing more fluid. Diffuse colloid struma may be found with perfectly normal function or accompanied by either in-

<sup>18</sup>*Geburtshilfliche Tagesfragen*. Edited by Med.-Rat Dr. Kupferberg. Repertorienverlag, Leipzig, 1925.

<sup>19</sup>*Précis d'Obstétrique*. Ed. 3. By C. Maygrier and A. Schwaab. Collection Testut. Gaston Doin and Cie, Paris.

<sup>20</sup>*Handbuch der Inneren Sekretion*. Vol. I, No. 3; Vol. II, No. 3; Vol. III, Nos. 2 and 3. By Dr. Max Hirsch. von Curt Kabitzsch, Leipzig.



crease or decrease of function. Struma nodosa (adenoma) is described, but the authors do not believe in its fetal origin.

The same authors describe the parathyroid. They go into the morphology and the changes in morphology in disease. They confess that our knowledge of this gland is still somewhat vague. I find not a single reference to Collip's work in their discussion except the paragraph, "The therapeutic results obtained by recent American authors with parathyroid extract in tetany are to be utilized in the same sense" (as parathyroid transplants in tetany).

The physiology of the thymus is discussed by Thomas. Nothing is known about thymus secretion. There are a few facts favoring a theory of a growth hormone. The effect on metabolism is nil. The extreme and rapid atrophy of the thymus in starvation is striking. A lympho-stimulating function is fairly certain, causing an increase and outpouring into the blood stream of lymphocytes.

A nearly 400-page article on the adrenals has been contributed by Bayer. As all previous authors, he divides the gland into chromaffin and cortical portion which are separately discussed. He is by no means certain that the chromaffin tissue is necessary for the continuance of life. Certain stimuli increase the adrenal secretion. Innumerable stimuli are discussed including drugs, chemicals and organ extracts. The pharmacology of adrenalin secretion, especially the effects on various parts of the circulation, the mucosae, organs and secretions are entered into in great detail as well as the discussion of the toxicology of this drug.

Death follows from complete removal of the cortex with constant, complete absence of the liver glycogen. There may be an effect on the vitamine metabolism. The question of a possible detoxifying rôle of the adrenals shows how little we know of this organ. Its influence on cholesterol, on pigmentation, on cholin production are all taken up, as well as the subject of hyperadrenalism. The adrenals, as is well known, regularly increase during pregnancy. A possible relation between the cortex and medulla has to be considered. This section is very detailed, very instructive, but would have been even more so if the author, whose experience in this field is extensive, had drawn his own deductions for the benefit of the readers and had summarized to a greater extent than he has.

A short chapter on the parotid, stomach, intestine, liver, and spleen is supplied by Zuelzer. He considers that the most important work on liver function has been contributed by Mann and Magath by their studies made after complete hepatectomy. This appears to show that grape sugar is really the liver hormone. Adrenalin mobilizes the glycogen in the liver. The gastric secretion may possibly be cholin. He believes that the parotid secretes a hormone antagonistic to adrenalin.

In Volume III, Installment 2, Josefson has described the clinical manifestation of hypophyseal disturbances. He gives a good clinical description of hypo- and hyperfunctional conditions. Evidently he does not believe in the efficacy of any hypophyseal extracts, nor does he ascribe any value to them in the treatment of hypofunction.

Aschner, who deals with the clinical manifestation of the epiphysis, on the other hand, shows marked credulity as to the effect of organotherapy. The epiphysis does not involute at the age of

seven years; it is effected by castration and pregnancy in both its size and shape. Epiphyseal disturbances manifest themselves by premature development, adiposity, and psychic disturbances.

Diseases of the thymus by Thomas. In this installment the author considers the thymus as a multiplier of the thyroid in Basedow. In the course of other endocrine diseases there may be thymus stimulation or, what shows clinically in the same fashion, a removal of thymus inhibition with consequent lymphocytosis, but throughout the thymus plays the subsidiary rôle.

The clinical pathology of the adrenals is taken up by Ehrmann and Dinkin. The best known syndrome is that of Addison which is a hypofunctional condition, manifesting both acute and chronic types, the latter with pluriglandular changes. Temporary Addisonian symptoms are common after infectious diseases, avitaminoses, rachitis and pregnancy. No definite proof has ever been offered of adrenalin reduction in the blood of Addison's disease. Adrenal therapy is rarely a success and if attempted, the fresh gland should be employed. The article contains much loose reasoning on the hypofunction of the medulla. The clinical reports on virilistic changes in females consequent to hypertrophy of the cortex are brought thoroughly up to date.

The longest chapters in this installment deal with the clinical pathology of the female sex glands as related to endocrine disturbances. These chapters should be considered more the expressions of opinion and the experiences obtained at the clinic of Prof. L. Fraenkel of Breslau than the fully accepted views now current. These chapters fill 200 pages. The subject is much complicated by the supposed interaction of various glands but for the sake of simplicity, has been divided into (1) disturbances of development, (2) functional changes, (3) pregnancy changes, (4) mammary influence, (5) tumors.

Herschman deals with developmental disturbances including precocious puberty, late menstruation, puberty bleeding, infantilism, asthenia, eunuchoidism, and hermaphroditism. To Geller was assigned functional disturbances. He considers every disturbance of cycle as hypo- or disfunctional and never as hyperfunctional. Just why he arrives at this conclusion, after the fairly definite evidence that my associates and I have offered on the blood findings, is not quite clear to me. He correctly concludes that histologic examinations will never solve the question and likewise that the *present* ovarian therapy does not substitute for lack of ovarian activity. Among the subjects taken up are ovarian sterility, fluor, general disturbances outside the genital system, climax and castration.

Hermstein deals with the breast. I notice that he still accepts Clayton and Starling's theory on the effect of fetal extracts on the breasts although this work has been repeatedly proved fallacious. Fraenkel himself deals with tumors of the endocrine glands in their relation to the genital system. This is a well written and interesting chapter which, however, is unconvincing because of the many gaps still existing in our knowledge.

The final installment in this series received is Volume III, Number 3, containing an article on cachexia strumipriva by Klose and Büttner. They discuss the history, the effects on adult and child, and the report made by Kocher in 1906 on 38 cases of total thy-

roidectomy. Of these, 26 per cent died, the average course being seven years. An interesting exposition of the effect of thyroidectomy on various species of animals is given. Myxedema following x-ray, the larvated or forme fruste are gone into. The authors seem to feel that thyroid medication does not always or entirely replace complete thyroidectomy.

The beginning of the long and complete monograph on goiter and cretinism by Eggenberger completes this installment. He enters into the distribution in endemic regions and into the interesting geographical variations. Careful details of how to measure the thyroid in the living are given. He estimates that in the entire world there are at least 15 million persons who show visible enlargement of the thyroid. Many good illustrations illuminate the text. The author believes that a morphologic-functional classification is impossible. Marine in 1907 first showed that endemic goiter was a deficiency disease and due to some chronic dietary deficiency. The thyroid evidently hypertrophies to obtain enough iodine from the diminished concentration found in the circulation. He describes in detail the until recently puzzling endemic areas often adjacent or surrounded by other areas relatively free of the disease. It was finally discovered that the source of salt in these endemic areas was different from that of adjacent cantons and due to the lack of iodine in the salt supply. In Switzerland iodine prophylaxis has been taken up by the government and has gradually become widespread. This article is particularly well planned and well carried out.

*Recent progress in endocrine therapy* as viewed by collaboration of numerous authors has just appeared.<sup>21</sup> The text is in the form of twelve lectures, the first by Prof. Carnot which deals with the general subject, such as implantations and transfusions of blood as a means of endocrine therapy. Weil prefers the citrate method of transfusion. Gley doubts that thyroxin is a fully purified hormone and suggest the hypothesis of several thyroid substances. Binet discusses the hypophysis. Baudouin, in my opinion, prematurely speaks of the use of an active anterior lobe extract. At the moment I know of no such active substances obtainable for therapeutic purposes. Pézard has an excellent article on the physiology of the male gonads. Vignes has an equally good discussion pertaining to the female gonads. He takes a commendably conservative stand on all the therapy. His optimism in regard to mammary gland extract seems unjustified to me.

In summing up this very valuable contribution, it appears that the exposition of the physiologic topics throughout has been sane, conservative and good, but that the authors unconsciously yielded to the pressure brought by the entire medical profession in their eager demand for effective endocrine preparations. The authors have been somewhat too optimistic in their conclusions on opotherapy.

#### MISCELLANEOUS

Royster has written on appendicitis,<sup>22</sup> appearing in the *Surgical Monographs* edited by Dean Lewis, Eugene H. Pool, and Arthur W.

<sup>21</sup>*Les Progres Recents en Therapie Endocrinienne.* By P. Carnot, P. E. Weil, E. Gley, P. Harvier, L. Binet, A. Baudouin, L. Hallion, F. Rathery, A. Pézard, H. Vignes, R. Gayet, and E. Gergen, J. B. Baillière et Fils, 1927.

<sup>22</sup>*Appendicitis.* By H. A. Royster, M.D. D. Appleton and Co., New York, 1927.

Elting. This monograph is gotten up in extremely attractive form and covers the subject in great detail. The author has accepted Fowler's classification of endo-, parietal-, peri-, and para-appendicitis, which, however, is purely descriptive, and then gives a second or clinical classification containing eight varieties. It appears to me that it would be better to adopt a classification such as that offered by Moschcowitz which conforms both to pathologic criteria and clinical needs. In the matter of diagnosis Royster believes that right salpingitis can more readily be excluded than has been my experience. He then quotes Ten Berge who in 24 cases made 3 wrong diagnoses, an incidence of error of 12 per cent! Metastatic carcinoma of the appendix deserves some mention although a very rare disease. He favors gridiron and right rectus incisions. The author apparently also prefers burying of the stump to simple ligation. All in all this monograph is both readable and instructive.

The second volume of *Operations of Surgery* by Rowland and Turner<sup>23</sup> is a profusely and adequately illustrated volume of nearly 900 pages. The subject covered in Volume II is the entire abdomen. The text is extremely detailed and carefully worked out. The world's literature is minutely gone into with references as footnotes, covering the entire world. American sources are given full credit. Operative indications are considered in each instance and the results of operations are likewise recorded. Both the male and female genital systems are included.

The book should prove a valuable guide not only to operative technic but also as a reference volume for looking up the literature.

Preoperative, operative and postoperative surgical technic, including the principles of anesthesia, asepsis and wound treatment are dealt with by Paul Zander<sup>24</sup> and his collaborators in a series of small booklets called *Kleine Klinische Bücherei*, Installment 28. The editor says that since the war, country doctors are operating more than previously. This book is designed for them as well as for the younger hospital assistants. The monograph, in addition, contains chapters on the treatment of furuncles, finger injuries, and infectious diseases of the physician. Numerous subjects are covered, such as indications, amelioration of pain, prevention of wound infections. Ether is preferred over other anesthetics, quite a new stand for central European authors to take. For skin disinfection 5 per cent iodine, 75 per cent alcoholic tannin solution, or 5 per cent thymol alcohol are advised, all of which disinfectants act similarly by shrinking and tanning the skin.

The *Textbook of Topographic Anatomy* by Blumberg<sup>25</sup> is written for the benefit chiefly of students, with the view of connecting their purely theoretic anatomic studies with clinical medicine and surgery. The author, until his retirement from active practice, was a surgeon and therefore fully appreciates the practical side of applied anatomy. The numerous and striking illustrations, whenever possible, are drawn from the right side of the body in order to facilitate orienta-

<sup>23</sup>The *Operations of Surgery*. By R. P. Rowlands, O.B.E., and P. Turner, B.Sc. Ed. 7, Volume II, The Abdomen. Macmillan Co., New York, 1927.

<sup>24</sup>Vorbereitung, Durchführung, Nachbehandlung chirurgischer Eingriffe Grundsätze der Schmerzbehandlung, Asepsis, Wundversorgung. Aus der Praxis fuer die Praxis. By Prof. Dr. P. Zander. Repertorienverlag, Leipzig, 1926.

<sup>25</sup>Lehrbuch der Topographischen Anatomie. By J. Blumberg. Urban and Schwarzenberg, Berlin, 1926.

tion. Of the 152 chiefly multicolored illustrations all but 9 are original. The book makes an excellent impression, the text being simple and clearcut. As an example of how carefully clinical points are kept in view, I may instance that both the lateral and posterior regions of the ribs are depicted and discussed in order to show that the needle, in aspiration of the pleura must be inserted close to the upper border of the lower rib posteriorly, while laterally the site of puncture should be equidistant from the two ribs. Even the female genital tract, which so often in books of this nature is most scantily dealt with, receives adequate treatment.

Keiller's *Nerve Tracts of the Brain and Cord*<sup>26</sup> is a short, well-planned book for students, which emphasizes particularly the anatomy, physiology, and pathology as an introduction to neurology.

Part I is designed to be used as a laboratory manual, for both normal and pathologic neurology. Part II applies these anatomic descriptions to the physiology, while Part III describes the clinical syndromes in a very clear-cut fashion. The illustrations are numerous but extremely crude, yet, although offending the artistic sense, they really illustrate the text convincingly.

*International Clinics*, Volume II, Series 37,<sup>27</sup> contains numerous articles of which none happen to be of particular interest to our readers with the exception of the rules for operation at the clinic for obstetrics and gynecology of the University of Florence.

The last number of *International Clinics*, Volume III, Series 37, 1927,<sup>28</sup> contains a number of interesting articles. One of the most stimulating is that of Theobald Smith on the *Passing of Disease from One Generation to Another and the Processes Tending to Counteract It*. The most striking examples are those of the chrysalis of the silkworm and ovum of the tick infected with Texas fever, in which the parasites are directly transferred by means of the infected ovum. He takes up malarial infestation of children in Africa, as well as tuberculosis and syphilis in the human being. The efforts to counteract and protect are well-evidenced by the antibodies obtained in milk. An interesting experiment is being conducted on a very small flock of sheep in whom successive generations of lambs have been repeatedly isolated and the parasitic infestation has been reduced to a minimum.

The article of T. R. Brown on *Colitis* is well worth reading, and that of C. E. Simon on the *Virus of Herpes Simplex* is of great importance. W. F. Harriman discusses the indications and contraindications of the Kielland forceps which he favors particularly when the head is in the transverse diameter.

*How to Make Periodic Health Examinations* by Fisk and Crawford<sup>29</sup> is a manual of procedure. The book is launched with a foreword by Major General Ireland and by introductions to each chapter by an imposing list of authorities no less than sixteen in number. Every

<sup>26</sup>*Nerve Tracts of the Brain and Cord. Anatomy: Physiology: Applied Neurology.* By Wm. Keiller, F.R.C.S. Macmillan Co., New York, 1927.

<sup>27</sup>*International Clinics. Volume II; Series 37.* J. B. Lippincott Co., Philadelphia, 1927.

<sup>28</sup>*International Clinics. Volume III; Series 37.* J. B. Lippincott Co., Philadelphia, 1927.

<sup>29</sup>*How to Make Periodic Health Examinations.* By E. Fisk and J. Crawford. Macmillan Co., New York, 1927.

portion of the human body is considered, also laboratory standards as well as methods of counselling. The book should prove a useful guide.

Bainbridge's book on *The Problem of Cancer*<sup>30</sup> is here presented in an Italian translation by Perilli and Pozzi with a preface by Alessandri. A very striking full-page photograph of the author, in uniform, forms the second frontispiece.

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<sup>30</sup>*Il Problema del Cancro*. By W. S. Bainbridge. Luigi Pozzi, Rome, 1927.

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Morris: On the Causes and Prevention of Maternal Morbidity and Mortality. Medical Journal of Australia, 1925, ii, 301.

While the death rate from general causes has been declining, the puerperal mortality rate has been rising. The puerperal mortality rate is excessive and is capable of being reduced. Though actual statistics of maternal morbidity are not available, there is little doubt that the total maternal morbidity exceeds by far the mortality resulting from pregnancy and childbirth.

Maternal mortality, and especially maternal morbidity, varies in direct proportion to the inefficiency or inadequacy of the professional care and supervision during the antenatal, natal, and postnatal periods.

The midwife's responsibility in the causation of maternal mortality is not as great as is customarily held; the medical profession must, individually and collectively, assume a larger share of such responsibility than has prevailed in the past.

Artificial abortion probably plays an important part in the production of maternal morbidity and mortality. Venereal disease, especially gonorrhea, is a potent factor.

Employment of women in Australia does not appear to have any marked effect on their maternal welfare. Insanitary conditions in the home have, apparently, little influence, at least on normal labors, though they probably increase the danger in those cases involving operative interference. The control of puerperal sepsis as a cause of maternal mortality in private practice has not been commensurate with that effected in public hospitals.

Operative procedures, especially delivery by forceps, are too frequently employed and leave in their wake a certain proportion of mortality and a far greater amount of morbidity and ill health.

Antenatal care and supervision afford a means of controlling much of the present maternal mortality and of eliminating most of the maternal morbidity. Its value is not fully recognized and, until it is, we shall not make any marked advance from the present unsatisfactory position.

NORMAN F. MILLER.

## Item

The Fifty-third Annual Meeting of the American Gynecological Society will be held at the Mayflower Hotel, Washington, D. C., on April 30, May 1 and 2, 1928.

## Books Received

GEBURTSHILFLICHE TAGESFRAGEN. Bearbeitet von Med. Rat Dr. Kupferberg, in Mainz. Repertorienverlag in Leipzig, 1925.

VORBEREITUNG UND NACHBEHANDLUNG CHIRURGISCHER EINGRIFFE. Von Professor Dr. Paul Zander, in Darmstadt. Repertorienverlag in Leipzig, 1926.

BIOLOGIE UND PATHOLOGIE DES WEIBES. Herausgegeben von Halban und Seitz. Lieferungen 38 and 39. Verlag von Urban & Schwarzenberg, Wein, 1927.

LEHRBUCH DER OPERATIVEN GEBURTSHILFE. Von Professor Dr. Georg Winter, Universitäts-Frauenklinik in Königsberg, unter Mitwirkung von Professor Dr. W. Benthin und Dozent Dr. H. Naujoks. Mit 228 zum Teil farbigen Abbildungen in Text und 11 Tafeln. Verlag von Urban & Schwarzenberg, Wien, 1927.

HANDBUCH DER INNEREN SEKRETION. Herausgegeben von Dr. Max Hirsch in Berlin. II. Band, Lief. 3. Verlag von Curt Kabitzsch, Leipzig, 1927.

INTERNATIONAL CLINICS. Vol. III. Thirty-seventh series. September, 1927, J. B. Lippincott Company, Philadelphia, 1927.

APPENDICITIS. By Hubert Ashley Royster, Raleigh, N. C. D. Appleton & Company, New York, 1927.

NERVE TRACTS OF THE BRAIN AND CORD. By William Keiller, professor of anatomy, University of Texas. The Macmillan Co., New York, 1927.

THE ANTISTERILITY VITAMINE FAT SOLUBLE E. By Herbert McLean Evans and George O. Burr. University of California Press, Berkeley, Cal., 1927.

DER KALKBEDARF VON MENSCH UND TIER. Von Dr. Oscar Loew. Verlag Otto Gmelin, Muenchen, 1927.

FRUEHENTWICKLUNG, EHAUTBILDUNG UND PLACENTATION. Von Professor Otto Grosser, an der deutschen Universitaet in Prag. Mit 297 abbildungen im Text. Verlag von J. F. Bergmann, Muenchen, 1927.

CONVALESCENCE, HISTORICAL AND PRACTICAL. By Dr. John Bryant. The Sturgis Fund of the Burke Foundation, New York, 1927.

METHODS AND PROBLEMS OF MEDICAL EDUCATION. Eighth Series. Rockefeller Foundation, New York, 1927.

INTERNATIONAL CLINICS. Volume IV, thirty-seventh series. J. B. Lippincott Company, 1927.

ANNUAL REPORT OF THE SURGEON GENERAL OF THE PUBLIC HEALTH SERVICE OF THE UNITED STATES. For the fiscal year 1927. Government Printing Press, Washington, 1927.

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No. 3

## Original Communications\*

### PRESIDENTIAL ADDRESS

BY JOHN OSBORN POLAK, M.Sc., M.D., BROOKLYN, NEW YORK

IT IS needless to tell you of my appreciation of the great honor which you have extended to me in electing me your presiding officer, the greatest honor that it has ever been my fortune to attain. For your confidence I thank you and trust that my administration of the office may justify it.

This Association has an enviable record, but it has yet many functions to perform for the betterment of American obstetrics, gynecology, and abdominal surgery. In my humble opinion the future development of the dual specialties must be the result of a firmer fusion between these two branches of medicine, for the basic pathology of the diseases which affect pelvic organs in women is founded upon the pathology of the traumatic lesions of childbirth and their consequent infections, and no surgeon who has not had training in obstetric pathology by autopsy study of the gross pathologic picture, supplemented by a study of the reparative and protective microscopic changes which take place in these tissues, can fully appreciate the resources of defense which Nature summons to her aid in the repair and arrest of these conditions.

Present-day surgery has accepted physiologic pathology as its guide for interference, and, if gynecic surgery is to keep abreast with the advances in other special lines, the men who go into this specialty must be equipped with this knowledge, as it pertains to the anatomic structures which constitute pelvic organs in women. It is, therefore, important that this Association place itself on record in favor of the combined Chair in the teaching of obstetrics and gynecology to our undergraduates; for the obstetrician must be a surgeon, likewise the gynecologist, a diagnostician.

\*As this issue is devoted entirely to the transactions of the Fortieth Annual Meeting of the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, the usual departments of the Journal are omitted.

NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."



That our obstetric defects are many is shown by the comparative study of the mortality statistics of any well-organized clinic, contrasted with the study of similar statistics as to the cause of death recorded in a metropolitan or rural health bureau. It is deplorable in this century, which shines with accomplishments in preventive medicine that any analysis of the deaths incident to childbirth show that 43 per cent are the direct or indirect result of infection; 26 per cent or more are due to the toxemias of pregnancy, while fully 10 per cent are directly the result of operative causes. Such a mortality from preventable causes does not obtain at the present time in any other branch of medicine, neither does it obtain in England, France, Germany, or Scandinavia. Let us, therefore, seek to find an explanation for this lamentable fact.

Careful investigation of existing conditions which I have made, shows that the didactic teaching of obstetrics in all Class A medical schools is uniformly good, but is not given the time commensurate with its importance. The student, under our present system, has such a very limited clinical training—so inadequate—that he is not in a position to recognize slight defects in mechanism, and their effect on the physiologic course of labor; neither is he properly equipped to do the common obstetric operations. The average student in the best clinics sees not more than fifty cases of labor, and probably delivers less than twenty. With the ordinary incidence of abnormalities, dystocias, and accidents, this means the possible chance of his seeing one breech delivery, two low forceps, one version, one cesarean section and, possibly, watching the treatment of one patient with a pre-eclampsia.

No man with such a paucity of surgical knowledge and experience would attempt to assume the responsibility of an abdominal operation, a thoracic paracentesis, or a mastoid drainage. Yet the graduate assumes, and the public accepts him as competent to handle, any obstetric delivery which in every sense is a surgical procedure. Even a midwife, trained abroad, has had ten times the clinical experience of our graduates in medicine, for every foreign midwife must have delivered at least two hundred cases, including versions and extractions, before being admitted to practice: even then she is subject to medical supervision and is responsible to the State for her errors, while our graduate, after passing the State Board examination and receiving his license, is controlled only by his conscience. Notwithstanding this, the Committee on Curriculum of the American Association of Medical Colleges and of the American Medical Association, apparently discounting the fact that obstetrics as it is taught in this country today is more poorly practiced than any other branch of medicine, are recommending a five-week block system of clinical obstetrics which will further curtail the clinical experience of the average medical graduate.

Obstetrics, medicine, and surgery should have an equal division of hours in the clinical year if we are to better the training of our graduates and give better service to the public. The importance of aseptic detail during the conduct of the first stage of labor should be so impressed upon the student that when obstetric operations are indicated and must be done, they will not be followed with the morbidity and mortality so common in present-day practice.

Routine manikin drill should be the coincident accompaniment of every clinic labor. By this method we can demonstrate the mechanism which is actually taking place in the case at hand, and so clarify the significance of many of the malpositions and their resulting dystocias. No textbook description, however lucid, can compare with visual demonstration or leave a like impression on the mind of the student. Furthermore, the usual custom of not calling a student until the woman is about to be delivered, or is in the second stage of labor, fails to teach him the important and essential point in every labor; namely, that dilatation takes time and pains, and that there are indications for and certain basic conditions necessary to accomplish safe delivery.

More emphasis should be placed on the fact that full dilatation of the cervix is a necessity before attempting any form of infravaginal delivery, and that this is accomplished by pains, time, and the physiologic pressure of the hydrostatic bag, less perfectly by the presenting part, and, finally, that manual or instrumental dilatation can never simulate the perfection of nature's physiologic mechanism.

Each student should be drilled in making abdominal, rectal, and vaginal examinations, in order to determine the presentation, position, steps of mechanism and to check the progress of the labor, as well as to recognize the degree of cervical dilatation.

Many men leave college with these facts driven home, only to read an article from the pen of some well-known teacher, calling attention to a method of shortening normal labor by operative measures. This Association cannot control the expression of the individual opinions of trained specialists, in whose hands radical procedures are relatively safe, but it can father the dissemination of rational practice for the rank and file. There should be a minimum standard of technic in obstetrics, just as there is a minimum standard in surgery.

The necessity for an endowment fund was conceived by your Secretary, to whose wisdom and energy we owe so much. This Association is a national institution with purposes and functions to perform that will outlive all of us as individuals, and I need not tell you that it takes money as well as brains to accomplish these. Even with the modest fund which is being established, we shall be able to spread our special knowledge to the general practitioner, stimulate research in the individual, and possibly establish a yearly fellowship for the

better training of eligible candidates. As the public will be the benefactor, it is from it—through you—that we may expect additions to this fund.

Another one of the responsibilities of this Association is not only to use its influence for the better teaching of obstetrics and gynecology to both the graduate in practice and the undergraduate, by encouraging the establishment of special teaching hospitals, but to endorse the lengthening of residence of the student in these services, so that he may become familiar with the diagnosis and management of obstetrics and gynecologic emergencies.

Another need of our Association is an editorial committee. Our Secretary is already taxed beyond his physical powers, yet he acts as editor of our transactions, for which he receives a nominal stipend and a deal of criticism. At each session there are from twenty to thirty contributions to our medical literature; many are suitable for journal publication, while others are of such a radical nature that the suggestions contained therein should be subjected to further trial by the trained expert before publication in the ordinary medical channels. These, of course, should be published as the author's individual opinion in our transactions, but should not go out to the profession with the visé of our Association until further proof of their excellence is submitted. An editorial committee selected from the teachers of our specialties in the universities should function with power in these matters, and in this way our Association would blaze the way toward better standards of teaching.

The present trend of obstetrics and gynecology is toward a better understanding of the underlying physiology, anatomy, and pathology of the lesions that we, as specialists, have to treat. Empiricism is fast becoming a thing of the past; we are more and more appreciative of both the interrelation and independence prevailing between gynecologic and obstetric lesions and general medicine, likewise of the significance of focal infections.

The uterus and its adnexa have been found to have less significance in the causation of symptoms than was formerly attributed to these organs. On the other hand, preoperative study and exact diagnosis are receiving more and more attention, while operative measures are falling into the class of preventive procedures rather than curative ones. Ablations are becoming less common as the significance of the interbalance of the endocrine glands is becoming better understood. All of these facts show that the obstetrician and gynecologist must be primarily a physician, trained in internal medicine with a firm grounding in his knowledge of anatomy, physiology, pathology, and bacteriology.

Studies of infection have shown that special bacteria have particular routes of invasion, a selectivity of tissue, and that they produce

definite and characteristic pathology. The permanence and extent of this pathology will depend on the type of bacterium and on the degree of tissue resistance. This latter varies with the condition and type of the individual. Thus, we find the gonococcus in certain locations with a limited life history, for the tissues affected show a reaction and power of regeneration capable of combating the invader; such a patient is left with but a limited permanent pathology. Furthermore, we have learned that the so-called exacerbations in pelvic inflammatory disease are, in reality, reinfections which originate from uncured foci, such as are found in the urethral and cervical glands.

On the other hand, puerperal and postabortal infections due to streptococci and staphylococci have a resulting pathology that is always more or less permanent, likewise the life history of the invading coccus is always questionable and varies from a few months to many years; hence, the significance of having a detailed history of the attack and a knowledge of the bacteriology, when determining the time for operative treatment. It has been proved beyond question that the uterus, its adnexa, and the surrounding parametrium and peritoneum are capable of combating a pure gonorrheal invasion, and that the results of such an infection can be so perfectly corrected by nature that pregnancy can and does occur; yet latent infections may remain quiescent in the urethral glands and in the glands of the uterine cervix for long periods of time and still retain their infectivity.

Admitting these clinical facts, radical extirpations in this form of infection, except when the invasion has been one of mixed origin, are procedures to be postponed; while, on the other hand, infections of puerperal or operative origin frequently show a wider degree of permanent tissue destruction, as well as a greater tendency to affect remote organs through extension, by the lymphatics and blood stream which seem less able than the uterus to cope with these virulent types of cocci. Furthermore, pathogenic bacteria having a greater longevity, become buried in an exudate or sealed in a wound, only to become reactivated by surgical trauma. All studies point toward the conservation of tissue and the capability of nature's resistance.

Notwithstanding the excellent work of Trendelenburg, Vineberg, and J. F. Baldwin, who, by ligation of the pelvic veins or panhysterectomy, aim to limit or extirpate the local infection, most authorities are convinced from the operating table picture, supplemented by autopsy and microscopic studies, that nature is doing just what we attempt to do in a better and more positive way, and that surgery, no matter by whom it is done, breaks down nature's barrier and spreads the infection.

Stimulation of the pituitary glands or the intramuscular use of pituitary extract in conjunction with repeated small transfusions of whole blood are now accepted as rational aids in the stimulation of

nature's supporting processes. Surgical procedure in the presence of streptococcic infection is limited in obstetrics and gynecology, as it is in surgery, to the incision and drainage of pus collection.

The repair of childbirth trauma is an accepted principle, but the time for such repair is still a question of debate. Theoretically, the immediate suture of such a lesion is ideal and should give satisfactory results; practically, however, owing to the severe tissue trauma and the usual accompanying edema, there is interference with the expected perfect union. In all the extensive injuries occurring in primiparae, our best results have been obtained by waiting for twenty-four hours, for even in this short time the edema more or less disappears, the injuries can be better exposed, and their extent more readily appreciated; hence, coaptation is more perfect and suture constriction may be avoided. The most aseptic technic, of course, is imperative.

Multiparae who have been subjects of previous obstetric injuries may have these lacerations repaired during the lying-in period. Here the intermediate procedure has been followed with excellent success. Our best results have been obtained by operating at the end of the first week, at which time, if there has been an afebrile convalescence, the cervix, anterior wall, and pelvic floor may be restored with reasonable expectation of success. Birth injuries left uncareed for lead to chronic invalidism from prolapse, displacement, menstrual disturbances and predisposition to local infection, local irritation, or faulty drainage which, in turn, favor the development of cancer of the cervix.

Taking up a consideration of the present status of uterine cancer we find, according to Hoffman's statistics for the year 1923, that out of every 100,000 persons dying from cancer in the United States, 57,397 were females and of these more than 40 per cent had the disease located in the genital organs or in the breasts. Soper, Hoffman, and others state that the incidence of cancer in the United States is increasing, and support this statement with detailed statistical tables.

These facts are discouraging and would appear to justify the pessimism of the public and some of the profession were it not that the great mass of experimental and clinical work which is being carried on by research students in this country and abroad has resulted in establishing certain incontestable facts which are of the utmost clinical value. It is to these that I wish to call your attention. While we must admit that our knowledge relative to the etiology and prevention of this malady is still defective, experimental and clinical study has resulted in giving us the most complete understanding of the pathology, incidence, routes of invasion, and clinical behavior of all forms of cancer. This is particularly true of cancer of the cervix and uterine body, for growths in this location are accessible to attack. The methods of diagnosis are positive and accurate, and the curative

treatment is effective, if the disease is detected in its earliest stage. Certainly these should be encouraging facts for both the profession and the public.

To combat any given disease, three basic factors must be dealt with: (1) the essential or primary cause, (2) the exciting or secondary cause, and (3) the cure. In cancer, the first factor is still unknown, though there are many theories to explain its origin. Graves, in a recent review of the cancer problem in gynecology, states that "of the various theories that seek to explain the neoplastic change of the cell, that of 'cell autonomy' is perhaps the most convenient as a working basis, for this theory assumes that normal cells grow under certain restraints which include: (1) tension of the surrounding tissues; (2) proper nutrition; (3) the necessity for function, and (4) the purposeful control of the organism, and that tumor cells which are emancipated from these growth restraints are merely exhibiting their normal capacity for growth, and become lawless." This so-called cell autonomy is so inclusive that in a general way it covers most of the well-known hypotheses as to the origin of cancer. Of these the dedifferentiation theory of Blair-Bell seems the most tenable and convincing, for it is supported not only by morphologic, chemical, and physiologic evidence, but by incontestable and demonstrable clinical results which have been achieved in the treatment of human cancer. Bell sees "in malignant neoplasia a reversion of the somatic cell to the earliest embryonic type which is represented by the chorionic epithelium. This dedifferentiation of the normal somatic cells may supervene on the common precancerous conditions produced by irritative factors, such as mechanical trauma, chronic inflammation, radiation, heat, and irritating chemicals. In the precancerous state there appears to be an oxygen starvation of the cell; this necessitates that the cell must then, either recover, or die, or undergo dedifferentiation, assuming the trophoblastic form in order to provide itself with sufficient nutriment."

The analogy of malignant cells to chorionic tissue is shown morphologically by the tendency to syncytial arrangement and by their power to invade blood vessels. Chemically, both tissues when compared with the normal show a high phosphatide-cholesterol ratio, which is an absolute requisite for cell membrane permeability and rapid growth.

Physiologically, the dedifferentiation theory is supported by the investigations of Warburg, who has proved that malignant cells obtain their energy by glycolysis in contrast to the oxidation method of nutrition of the normal tissues. In further support of Warburg's observations, Blair-Bell, of Liverpool, and Murphy, of the Rockefeller Institute, have shown that chorionic tissue behaves in an identical manner.

Toxicologically, both malignant and chorionic tissues show the same reaction; namely, that of coagulation necrosis to lead, while clinically,

this theory is supported by the observation that abortions are specifically frequent among lead workers, contrasted with the fact that persons suffering from chronic lead poisoning never develop cancer. While the acceptance of this theory as to the essential cause is still debatable, certain secondary causes particularly those of chronic irritation and chronic inflammation have long been accepted as precursors of cancer.

The work of Gye, who believes that the stimulating virus of cancer is due to an invisible, filterable bacterium, deserves attention for opening up new fields of investigation that are already leading toward tenable grounds.

In contrast to these speculative theories certain clinical observations regarding the effect of chronic irritation and chronic inflammation have been recorded for many years. These are best illustrated in the neglected lacerations and chronic erosions of the cervix which are more or less constant precursors of cervical epithelioma. These clinical observations have been further supported by experimental studies of the production of cancer in rats and rabbits by chronic irritation.

The incidence of obstetric traumas preceding cancer of the cervix is estimated at from 90 to 98 per cent. In the analysis by Graves of 538 cases of cancer of the cervix there was an incidence of 91 per cent; all of these women had borne children or had had one or more miscarriages. Contrasted with this is a study of the hospital records of 4,815 cervical repairs, which included the operations of trachelorrhaphy, amputation, and cauterization; follow-up records found only seven cases that later developed cancer, and in three of these malignant changes were already present in the tissue removed at the time of the primary operation. Such statistics as these, coming as they do from a reliable source, direct our attention to the importance of the repair of cervical lesions as a cancer prophylactic.

In the study of body cancers, Graves found a large proportion of senile atresias which produce a tangible irritative process by causing the retention of uterine secretions, chemically changed and exerting pressure and irritation for long periods on the senile epithelium of low differentiation, with its tendency to heap up into papillomatous masses. So constant was this observation that we must admit the possibility of gynatresia acting as an etiologic factor in corporeal cancer.

The diagnosis is accurate and positive if reliance is placed on routine microscopic study of all biopsy and curetted material. There are no physical signs which are pathognomonic of incipient cancer. In cancer of the cervix only Group I cases are amenable to total extirpation or cell destruction by irradiation; hence, it is apparent that the early detection is the keynote of success, for every failure to make the diagnosis in the incipient stage costs a human life.

From this brief review we can make the following deductions: (1) that cervical cancer may be in great part prevented by the proper attention to obstetric trauma and to chronic cervical infections, and the incidence of corporeal cancer may be diminished by establishing proper drainage in the gynatresias; (2) that early detection is imperative and that routine microscopic studies of all tissues removed at trachelorrhaphy, tracheloplasty, or amputation and of all curettings will discover malignant neoplasia at a time when radical surgery or cell destruction is possible, for, unless this extirpation or destruction is complete, surgery not only shortens the woman's life but makes her life more miserable.

20 LIVINGSTON STREET.

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## THE FLUCTUATION IN BLOOD SUGAR DURING ECLAMPSIA AND ITS RELATION TO THE CONVULSIONS

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EVIDENCE is now available, as the result of an arduous series of investigations over a period of several years, which indicates that the opinions generally held regarding certain important blood chemistry changes in eclampsia are partially incorrect.

As stated in our preliminary report,<sup>1</sup> we are now prepared to furnish proof by means of these studies, (1) that a disturbance in carbohydrate metabolism in eclampsia actually exists, (2) that contrary to the general opinion, hyperglycemia is not characteristic of eclampsia, but (3) that eclamptic convulsions are directly related to and probably the result of hypoglycemic levels during the course of this disease.

It is obvious that if our observations are correct, they must have a definite and direct bearing on both the etiology and the treatment of eclampsia.

### THEORETIC RELATIONSHIP BETWEEN DISTURBANCE OF CARBOHYDRATE METABOLISM AND TOXEMIAS OF PREGNANCY

Hofbauer<sup>2</sup> was the first to adduce evidence of the glycogen depletion of the liver which is "common" to pregnancy, and he even designated the histologic changes resulting from this process as "the liver of pregnancy." Furthermore, his analyses of the glycogen content of the livers of eclamptics showed a relationship between the degree of glycogen depletion of the liver and the pathologic degenerative changes seen in the tissue of this organ.



As long ago as 1920 one of us (Titus<sup>3</sup>) postulated the theory that a profound disturbance in carbohydrate metabolism resulting from an actual deficiency in carbohydrates seemed to be the underlying factor in the development of pregnancy toxemias. Duncan and Harding<sup>4</sup> had advanced a similar theory shortly before, but the explanation of the source of this deficiency as conceived independently in our clinic differed somewhat from theirs and was briefly as follows: "The liver is the carbohydrate storing organ of the body, its cells being filled with glycogen, and a carbohydrate deficiency in the maternal organism causes a glycogen depletion of the liver. Such a deficiency of carbohydrates during pregnancy may be of twofold origin: (1) There is an unexpected demand for glycogen on the part of the fetus, as shown by Slemmons<sup>5</sup> and others, and to a lesser degree by the rapid hypertrophy of the uterus, this being a relative deficiency, and (2) an actual deficiency augmented in the presence of nausea and vomiting, from lessened carbohydrate intake as the result of an improperly balanced diet. All degrees of variation in this are possible during pregnancy."

It was reasoned that depletion of the liver cells of their stored glycogen might well be the starting point for the development of a pregnancy toxemia, and it was shown by further work of our group<sup>6</sup> that this also had a direct relationship to the pathologic lesions of the liver which are seen in these toxemias, thus corroborating certain of Hofbauer's earlier findings.

#### THERAPEUTIC APPLICATIONS OF CARBOHYDRATE DEFICIENCY THEORY

Our earlier studies dealt chiefly with hyperemesis, because this toxicosis of early pregnancy is so common that large numbers of cases are always available for study. Cases of eclampsia were, of course, included.

Based on this theoretical deficiency and disturbance in metabolism of carbohydrates, we developed a definite line of treatment, and one important feature of this was the recommendation made here for the first time that the intravenous administration of hypertonic glucose solution be utilized for all toxemias of pregnancy. This treatment, begun experimentally and suggested by Litchfield's<sup>7</sup> work with glucose in pneumonias, has since been developed and extended both by us and by others to the point where it has now become quite generally accepted and successfully used, not only in obstetrics but also in surgery.

Williams<sup>8</sup> in the last edition of his textbook, as well as in later publications, accepted and approved the suggestion of intravenous glucose therapy because of its liver-sparing effect but stated that in eclampsia there is no evidence of a carbohydrate insufficiency as we had suggested.

It seemed inconceivable, however, that our reasoning along such definite physiologic lines could be so faulty, especially when the clinical results in this treatment of even severe grades of hyperemesis were so favorable. Glucose therapy seemed to be a most reasonable thing for eclampsia if for no other reason than that the enormous consumption of energy incidental to the convulsions required this fuel to replace the depleted stores. The results of this therapy promptly proved to be equally satisfactory to those seen in hyperemesis. An intravenous injection of a strongly hypertonic glucose solution has a striking effect in controlling both the severity and the number of the convulsions as well as in lowering blood pressure and stimulating diuresis.

#### CURRENT OPINION ON BLOOD CHEMISTRY IN ECLAMPSIA

It has been reiterated by many authorities that an increase in blood sugar (hyperglycemia) is characteristic of eclampsia. Various investigators have made the general statement that blood chemistry studies have been disappointing because the only changes seen in eclampsia are an increase in sugar, and a lesser increase in uric and lactic acids, none of which seemed to throw any light on the etiology of the disease.

In his latest publication on the subject of eclampsia Williams<sup>9</sup> says that "there is a marked increase in the uric acid content (of the blood) followed by equally striking changes in the amount of sugar and lactic acid. . . . The changes noted in eclampsia . . . do not in any way bear out the original supposition that it is associated with nitrogenous retention, but indicate a profound disturbance of metabolism." He gives as the usual average of blood sugar during eclampsia a hypercontent of from 120 to 185 mg. per 100 c.c.

Benthin<sup>10</sup> was among the first to say that in eclampsia the blood sugar is nearly always raised above the upper border of normal, concluding that this increase is an effect of the muscular activity during the convulsions. Widen<sup>11</sup> found an intermittent hyperglycemia as a characteristic symptom of eclampsia and believed that the prognosis was improved in the presence of increased blood sugar. Slemons<sup>12</sup> refers to the hyperglycemia following eclamptic convulsions and for lack of evidence he too discards the nitrogenous retention theory of the disease. Plass<sup>13</sup> agrees with this latter and also says "thus far, no definite metabolic changes have been associated with the actual convulsive seizures."

Stander and Duncan<sup>14</sup> even go so far as to make the suggestion that because of the constancy of hyperglycemia in eclampsia one should take this for granted when laboratory facilities are lacking, and administer insulin even without the precaution of carrying out blood-sugar readings.

#### CONTRADICTORY OBSERVATIONS ON BLOOD SUGAR IN ECLAMPSIA

In connection with some glycemia-curve estimations in eight eclamptic women reported in an earlier paper by our group,<sup>6</sup> it was noticed that only four of them showed an initial blood sugar above 110 mg. per 100 c.c., and one of the other four was as low as 77 mg. Obata and Hayashi<sup>15</sup> have found the blood-sugar levels in eclamptics approx-

imating those of normal women, although a few of their cases showed some increase. They quote both Bergsma and Moritani as having been unable to find any difference between the blood-sugar levels in normal women and eclamptics.

Recently, Levy<sup>16</sup> of New Orleans has commented as follows: "findings of an increased blood-sugar content (in eclampsia) are directly contrary to mine of a consistently lowered one."

It seemed apparent, therefore, that hyperglycemia is not as constant a feature of eclampsia as was commonly assumed. Parenthetically it may be said that lactic acid is merely a by-product of muscle-work<sup>17</sup> and that experimental muscular contractions are followed by a definite ratio of lactic-acid increase in both muscles and blood stream up to the point of muscular exhaustion. We are not concerned with this at present, however, more than to offer it as an explanation of what has been considered another constant of eclamptic blood chemistry; namely, increase in lactic acid.

#### DEVELOPMENT OF GLYCEMIA CURVE STUDIES DURING ECLAMPSIA

The discovery of insulin was an enormous stimulant to research in carbohydrate metabolism. It was soon shown that insulin overdosage produces a lowering of blood sugar with a simultaneous depletion of the glycogen of the liver<sup>18</sup> and that at certain hypoglycemic levels severe convulsions occur which could promptly be relieved by the administration of glucose or other carbohydrates.

Our earlier attempts to explain the success of the empiric carbohydrate treatment of pregnancy toxemias on the theory that these intoxications develop only in the presence of a carbohydrate deficiency had previously carried us over a course of reasoning almost parallel in pregnancy toxemia to these new developments in this other field. We were still faced, however, with the glaring inconsistency that eclampsia was apparently accompanied by increased rather than lowered blood-sugar values.

Recalling the lowered blood-sugar readings which we and others had reported in occasional cases of eclampsia, and also that hyperglycemia of varying degree usually follows any sudden muscular exertion, we conceived the idea that there might be fluctuations in the blood sugar during eclampsia.

If our theories were fundamentally correct as we believed, it was logical to expect that blood-sugar values would be low before a convulsion, and that following this tremendous muscular upheaval, they would rise to hyperglycemic levels.

The actual attempts at carrying out an investigation of these ideas proved to have many technical difficulties, and at the outset of this work a number of cases were totally wasted, so far as profitable study was concerned, in the effort to perfect our details of technic. It was simple enough to reason that blood taken just before a con-

vulsion might show a vastly different sugar level from that taken shortly after, but no one could foretell when a convulsion would occur and therefore when to take such a desirable specimen.

In order to be certain of obtaining such specimens, it was necessary to arrange to take a series of blood samples at stipulated intervals, hoping to be fortunate enough to secure some of them just before convulsive seizures occurred. This often involved hours of tedious and fruitless work, but by serving in relays, we were able in a number of instances to get precisely what we sought.

Another difficulty lay in the matter of treatment. It was quite important from our standpoint that during the time these specimens were being taken the patient should receive no treatment. Consequently the time which could be allotted to these studies was often necessarily shortened by the patients' requirements, since we had no intention of endangering their lives.

#### INITIAL BLOOD-SUGAR LEVELS IN OUR SERIES OF ECLAMPTICS

Despite the fact that practically all of these patients had been given at least one dose of morphine before being sent to the hospital (according to Stander<sup>19</sup> this increases blood sugar), only four of the thirteen patients studied showed an initial sugar reading above 110 mg. per 100 c.c. of blood. Four were found at average or normal levels (two at 100, one at 105 mg. and one at 110 mg. respectively) while the remaining five were all below 90, one even being at the low level of 55 mg.

Quite contrary, therefore, to the usual opinions, we found normal and lower than normal values predominating.

#### FLUCTUATIONS IN BLOOD SUGAR DURING ECLAMPSIA, AND THEIR SIGNIFICANCE

As will be seen by the charts presented herewith, it was soon evident that our lines of reasoning had been correct. By taking frequent blood-sugar readings during an attack of eclampsia, wide fluctuations in the values were readily demonstrated, these variations being encountered in surprisingly short intervals of time. Such differences as 50 to 80 mg. or more of sugar were common and repeated occurrences in time intervals of only a few minutes (110 mg. change in fifteen minutes time in one extreme instance).

After noting these striking fluctuations in eclampsia, serial readings of blood-sugar (fasting) values were taken in normal pregnant women near term for control. It will be seen by the graphs in Chart I that these values are maintained at constant levels over a period of several hours, and in no way resemble those of the eclamptic cases. It is planned to extend these normal studies which apparently have not been done before, and to include with them patients having pre-eclampsia and other less acute toxicoses of late pregnancy.

From a study of the curves of our eclampsia cases it is now possible to state as the general rule that eclamptic convulsions are preceded by definite and sudden drops in blood-sugar values which may vary all the way from 10 or 15 mg. to as much as 80 mg. Exceptionally such decreases in our curves were not followed by convulsions, but the rule was so definite that we believe a convulsion was threatened at each of these lowered points.

We had expected to find a sharp rise in blood sugar following each convulsion, and over a considerable period of this research our efforts were bent mainly toward obtaining specimens directly before a convulsion or just as it began, and within a minute or two after the seizure. It was in this way that a number of cases were practically lost for study because the most important findings representative of the entire case were to be developed from the more constant blood-sugar readings and the curve plotted therefrom. This, or the similar technical mistake of taking only occasional specimens might cause

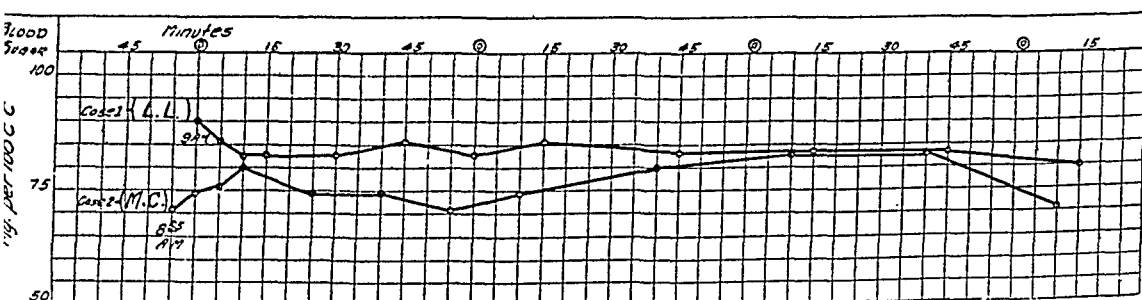


Chart I.—Blood-sugar curves in two normal, nontoxic pregnant women near term; specimens taken after overnight fast. No fluctuations and comparatively little variation in three and a half hours.

various conflicting ideas. The misleading results of taking specimens too infrequently is illustrated by the typical cases (2 and 3) plotted in Chart VII. We show these curves in order that any other investigators desiring to carry out similar studies will avoid these conflicting errors.

Following a convulsion, the patient usually has a more or less temporary rise in blood sugar, undoubtedly the effect of the enormous muscular activity of the convulsion itself. The physiologic response of the liver to any muscular activity is to throw out glycogen from its reserve stores, and blood sugar is thereby immediately increased. In eclampsia, there is a constant tendency toward remissions to lower levels so that the general trend of the sugar content of the blood was found to be downward, a phenomenon which we attribute to a steady exhaustion of the liver's glycogen reserve.

It was to be foreseen that several factors would influence or affect the level at which blood sugar is found at the beginning of the study of an eclamptic. Some of these are (1) the general state of the patient's nourishment before the attack, (2) the number of convulsions

which had already occurred, (3) the severity of her convulsions, and (4) the frequency with which they were recurring. Hypothetical variations from normal toward hypo- or hyperactivity of the patient's pancreas in its insulin-producing properties has also been considered by us as being of possible importance but cannot be discussed at this time.

The temporary increase in blood sugar from muscular exertion is augmented in eclamptics by two additional factors having the same effect, according to Stander;<sup>19</sup> namely, periods of moderate asphyxia plus the morphine which is customarily administered quite promptly in the routine treatment of these patients. The fact that we found a glycemia above 125 mg. in only three of our cases is additional evidence, therefore, of the correctness of our contention that hyperglycemia is not characteristic of eclampsia.

It is not surprising, however (to quote again from our preliminary report), that various investigators have been misled to believe and advance the dictum that hyperglycemia is the rule in eclampsia, whereas we interpret it as being merely an incidental and temporary effect of these factors mentioned above. The prevailing view at the present time is probably due to the fact that only one or two specimens are ordinarily taken in a more or less perfunctory way during the course of an attack of eclampsia (usually following a convulsion) and the sugar levels found in these considered as representative of the entire case, and also of the disease.

So far as we can learn no such studies of blood-sugar curves have hitherto been made either in toxemia of pregnancy or even in normal pregnant women, and we believe that this work now establishes a definite association between disturbances in metabolism and the convulsions of eclampsia. Moreover, we already have reason to believe that it opens up a field of investigation which should throw new light on the etiology of other toxemic disturbances during pregnancy, even to the extent of establishing a relationship between them all.

Blood chemistry studies which included similar serial readings of nonprotein nitrogen, urea, and uric acid were made in a sufficient number of instances to establish that in these three constituents there is no fluctuation at all comparable to that of the blood sugar.

We are now prepared to make the statement that in eclampsia it is characteristic for the convulsions to be preceded by periods of relative hypoglycemia.

#### EXPLANATION OF THE TERM "RELATIVE HYPOGLYCEMIA"

A blood-sugar level of 140 mg. per 100 c.c. (as in Chart II) may be considered a relative hypoglycemia when it had been 175 mg. only twenty minutes before, and 222 mg. thirty minutes before that. Likewise a fall from 152 mg. to 117 mg. in an interval of only twenty



this interval. Moreover, five minute readings were not being taken, so that further information which might change the picture was not available. Even in Case 2, Chart VI, where convulsions were occurring so frequently as to be confusing, unless readings could be made at intervals of a minute or two, fall after fall preceded them.

It is desired at this point to call attention again to the sharply contrasting curves taken for control in normal pregnant women near term.

Based on general experience with insulin overdosage, both experimental and clinical, the tendency is to think of hypoglycemic symp-

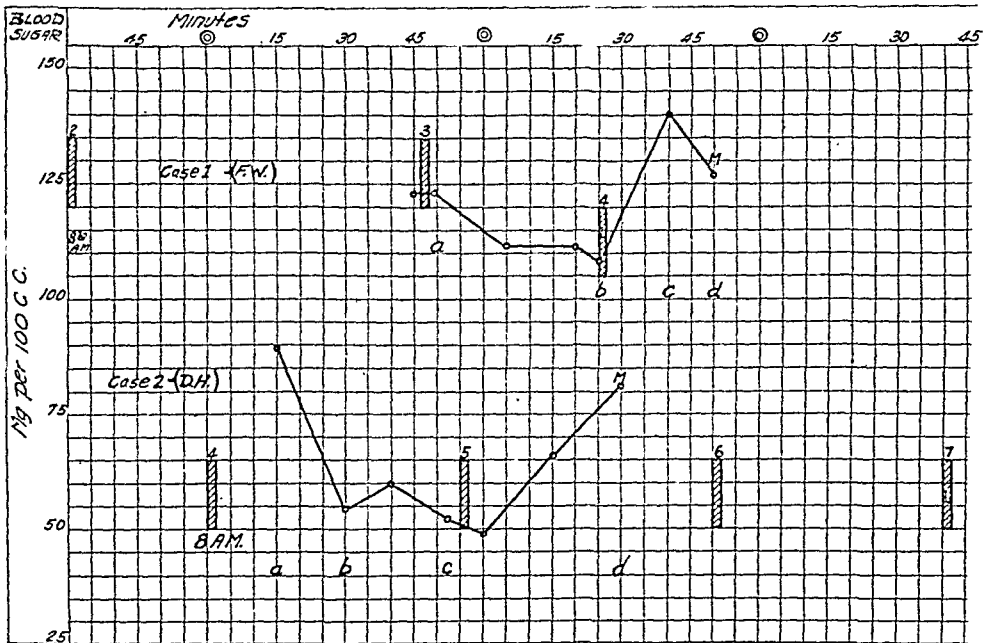


Chart III.—Same symbols as in Chart II.

Case 1: Blood-sugar curve in active eclampsia.

Initial level 123 mg., highest level 140 mg., lowest level 108 mg. sugar per 100 c.c. of blood.

Period a to b: Moderate drop in blood sugar (15 mg. in thirty-five minutes) followed by convulsion.

Period b to c: Relative hyperglycemia as reaction from convulsion.

Period c to d: Probable beginning of remission; medication begun.

Case 2: Blood-sugar curve in active eclampsia.

Initial level 89 mg., highest level 89 mg., lowest level 48 mg. sugar per 100 c.c. of blood.

Period a to b: Hypoglycemic fall from 89 to 54 mg. in fifteen minutes.

Period b to c: Convulsion imminent at point b, avoided by momentary reaction, was followed by further fall and convulsion.

Period c to d: Hyperglycemic reaction from convulsion; medication begun.

Two additional convulsions without blood-sugar data.

toms (nervousness, tremor, twitching, and convulsions) as occurring only at or below the level of 70 mg. of sugar per 100 c.c. of blood, or thereabouts.

MacLeod<sup>20</sup> makes an interesting observation in this connection, however, which has a bearing on our studies. He says in effect that the level at which hypoglycemic symptoms follow insulin administration may depend not so much on any absolute level of blood sugar as it does on the rapidity with which that level is reached. In other words,





## GENERAL DEDUCTIONS

As a result of our clinical and experimental studies<sup>3, 6, 21</sup> of those toxemic disturbances seen in the early, as well as those in the late weeks of pregnancy, we are convinced (1) that there is a definite relationship between the two, (2) that the difference between the hepatic lesions of the two states is less distinctive than has been generally supposed, (3) that there is no specific toxin of fetal origin responsible for these toxic states, (4) that eclampsia in particular and other toxicoes of pregnancy as well are due entirely to disturbance in maternal metabolism, (5) that nitrogenous metabolism plays no rôle in this,

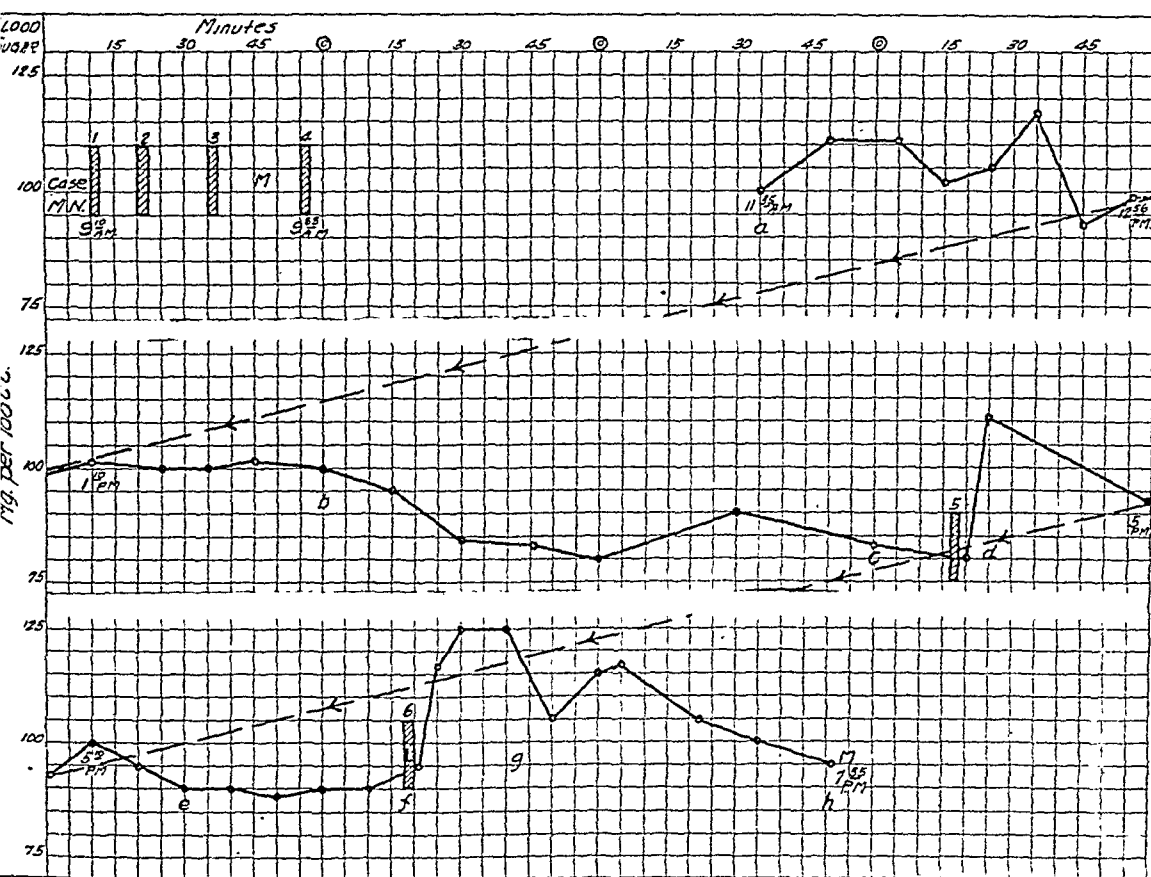


Chart V.—Blood-sugar curve in slowly progressing case of eclampsia.

Initial level 100 mg., highest level 125 mg., lowest level 80 mg. sugar per 100 c.c. of blood.

Between third and fourth convulsion patient had been given morphine, gr.  $\frac{1}{2}$ , by hypodermic, and chloral hydrate, gr. xxx, by rectum.

Period a to b: (Arrow-marks continue graph to middle panel.) No marked fluctuations; patient resting quietly; narcotics apparently still effective.

Period b to c: Gradual decline in blood sugar. Clinically patient seems improved, arousing occasionally and asking questions. At point c no clinical warning of impending convulsion but blood sugar proved to be at low ebb.

Period c to d: Convulsion caused sharp rise in blood sugar.

Period d to e: (Arrow-marks continue graph to lower panel.) Remission downward more rapid than in period b to c.

Period e to f: Low level of blood sugar might have caused convulsion 6 (L) to occur at any point in this period.

Period f to g: Sharp rise following convulsion.

Period g to h: Rapid remission downward; convulsion probably imminent.

Point h: Medication begun; morphine, gr.  $\frac{1}{4}$ , by hypodermic, and intravenous injection of glucose (200 c.c. 25 per cent solution in one hour, ten minutes). No more convulsions.

and (6) that this disturbance is one of carbohydrate metabolism, based primarily on a deficiency in carbohydrate intake plus increased consumption of carbohydrates resulting in a depletion of the glycogen stores with consequential damage to the liver and its functions.

In corroboration of these assertions we wish to assemble and correlate as briefly as possible a small part of the immense amount of investigation which has been done on this and related subjects.

Regarding the first point, both hyperemesis and eclampsia (to consider only the outstanding "toxemias" of early and of late pregnancy) have pregnancy in common. The most distinctive pathologic change in fatal cases of each of them are focal necroses of the liver lobules.

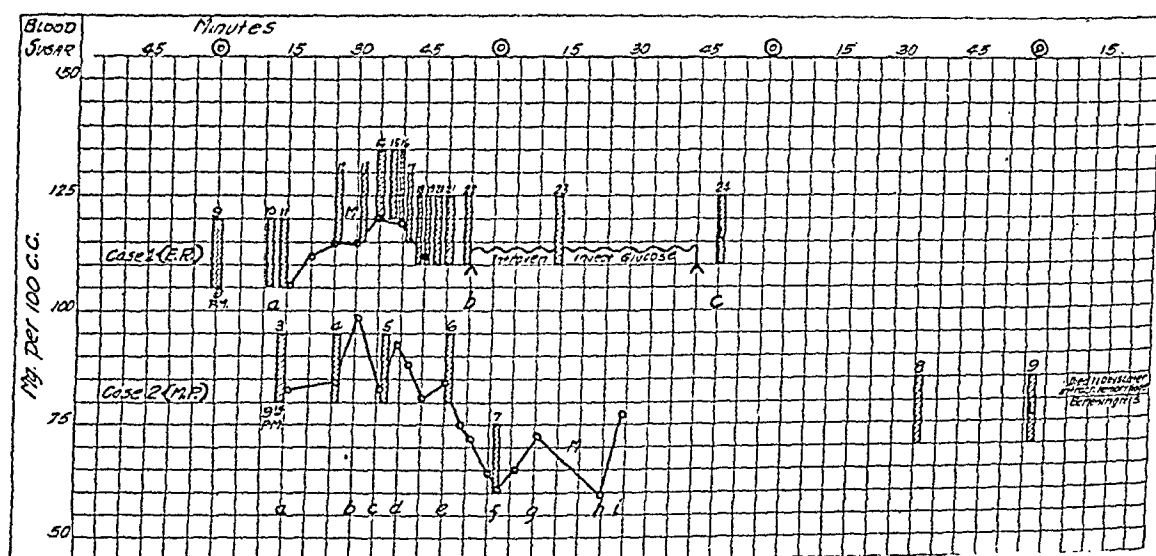


Chart VI.—Blood-sugar curves in two rapidly progressing cases of eclampsia, with frequently recurring convulsions.

Case 1: Convulsions recurring at such frequent intervals (60 to 90 seconds apart) that comprehensive data were not obtainable.

Initial level 106 mg., highest level 120 mg., lowest level 106 mg. sugar per 100 c.c. of blood.

Period b to c: Illustrates effect on convulsions of intravenous injection of hypertonic (25 per cent) glucose solution.

Case 2: Fluctuations present but their degree affected by frequency of convulsions. Initial level 83 mg., highest level 98 mg., lowest level 59 mg. sugar per 100 c.c. of blood.

Period a to b: Two convulsions in eleven minutes, followed by rise in blood sugar.

Period b to c: Fall in blood sugar; convulsion.

Period c to d: Rise following convulsion.

Period d to e: Fall in blood sugar; convulsion.

Period e to f: Sharp fall (84 mg. to 65 mg.) in ten minutes.

Period f to g, g to h, h to i: Further fluctuations without convulsions; medication begun.

We now have work nearly ready for publication which demonstrates a marked carbohydrate depletion or deficiency with hypoglycemia the outstanding feature of the blood picture in hyperemesis, while this present report deals with the fluctuations in blood sugar during eclampsia and the relation of the hypoglycemic levels to the actual production of the convulsions. Therapeutically the intravenous administration of hypertonic glucose solution has been proved to have

immediately beneficial effect in both conditions. Many authorities, notably Freund,<sup>22</sup> believe in such a relationship, and it is not unreasonable.

Regarding, secondly, the pathologic changes noted, it has been said that there is a distinctive histologic difference between the two conditions. Our own work<sup>6</sup> not only failed to demonstrate such a contrast but also showed that the usual pathologic picture was altered in women who had received glucose injections. Bell<sup>23</sup> concludes after a careful histologic study of toxemia of pregnancy in which the out-

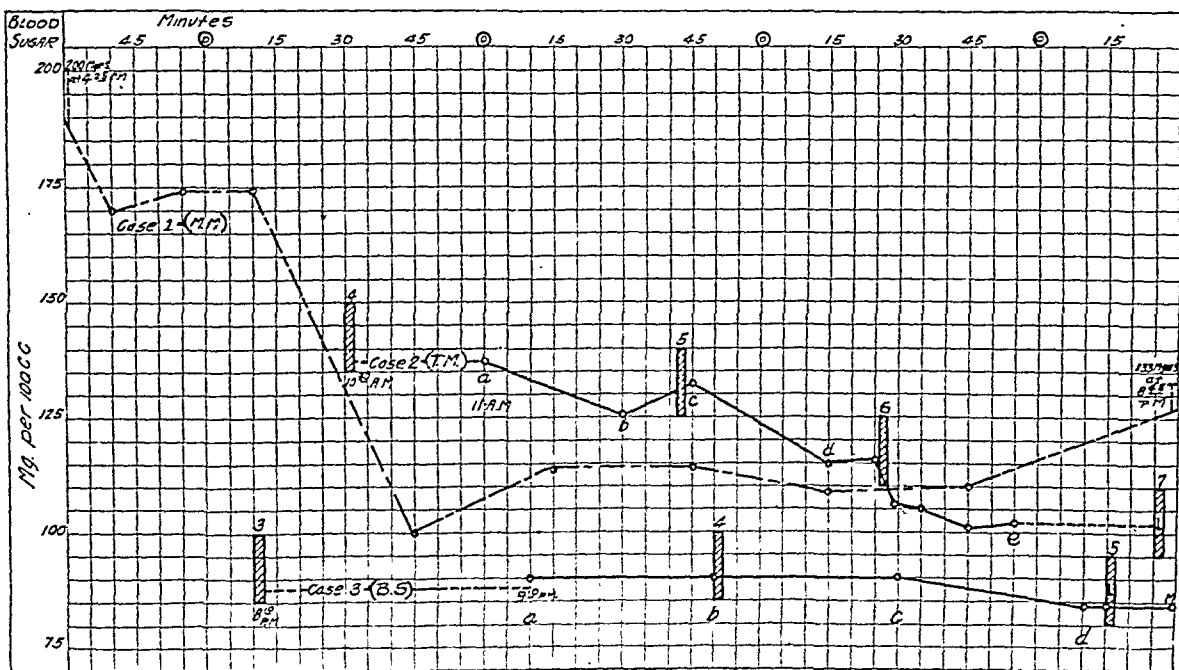


Chart VII.—Three of our earlier cases; inconclusive because technic not yet properly developed and specimens taken too infrequently.

These cases are shown to illustrate what seemed at first to be results contradictory and discouraging to our theories, but which later proved to be due to faulty technic in our study of the cases.

Case 1: Initial level 200 mg., highest level 200 mg., lowest level 100 mg., sugar per 100 c.c. of blood.

Two convulsions occurred, but by an unfortunate error the exact time at which they took place was recorded only on the nurses' record. In filing the history, the nurses' record was destroyed, so that this graph permits no conclusions. It shows, however, an interesting fluctuation which is similar to those of the other more complete cases.

Case 2: Inconclusive case because of infrequent readings at critical times.

Initial level 137 mg., highest level 137 mg., lowest level 102 mg. sugar per 100 c.c. of blood.

Period a to b: Moderate fall; convulsion twelve minutes after b.

Period b to c: Point c slightly higher than b.

Period c to d: No readings to show probable rise and fall but d is 10 mg. lower than b and 17 mg. lower than c. This period represents an unfortunate omission.

Period d to e: Convulsions without blood-sugar increase in response. This is apparently contradictory but is to be explained as in other instances as due to advancing depletion of glycogen reserve stores.

Period e to last convulsion: No specimens taken.

Case 3: Entirely inconclusive because specimens a and b were taken just as convulsions began, with no intervening specimens.

Initial level 90 mg., highest level 90 mg., lowest level 89 mg. sugar per 100 c.c. of blood.

Specimen at c taken forty minutes after convulsion instead of five minutes later as should have been done.

Specimen at d, after another forty minute interval, but five minutes before a convulsion.

Period c to d would probably have shown some interesting fluctuations had specimens been taken more frequently during this time.

standing features which he found were fatty infiltration, infarction, and hemorrhagic necrosis that his "data weakens our belief in any one lesion of the liver being considered essential for toxemia of pregnancy." Finally, similar liver lesions occur in fatal cases of simple starvation.

The third conclusion, against there being a specific fetal toxin, arises from the fact that in spite of a vast amount of work designed to

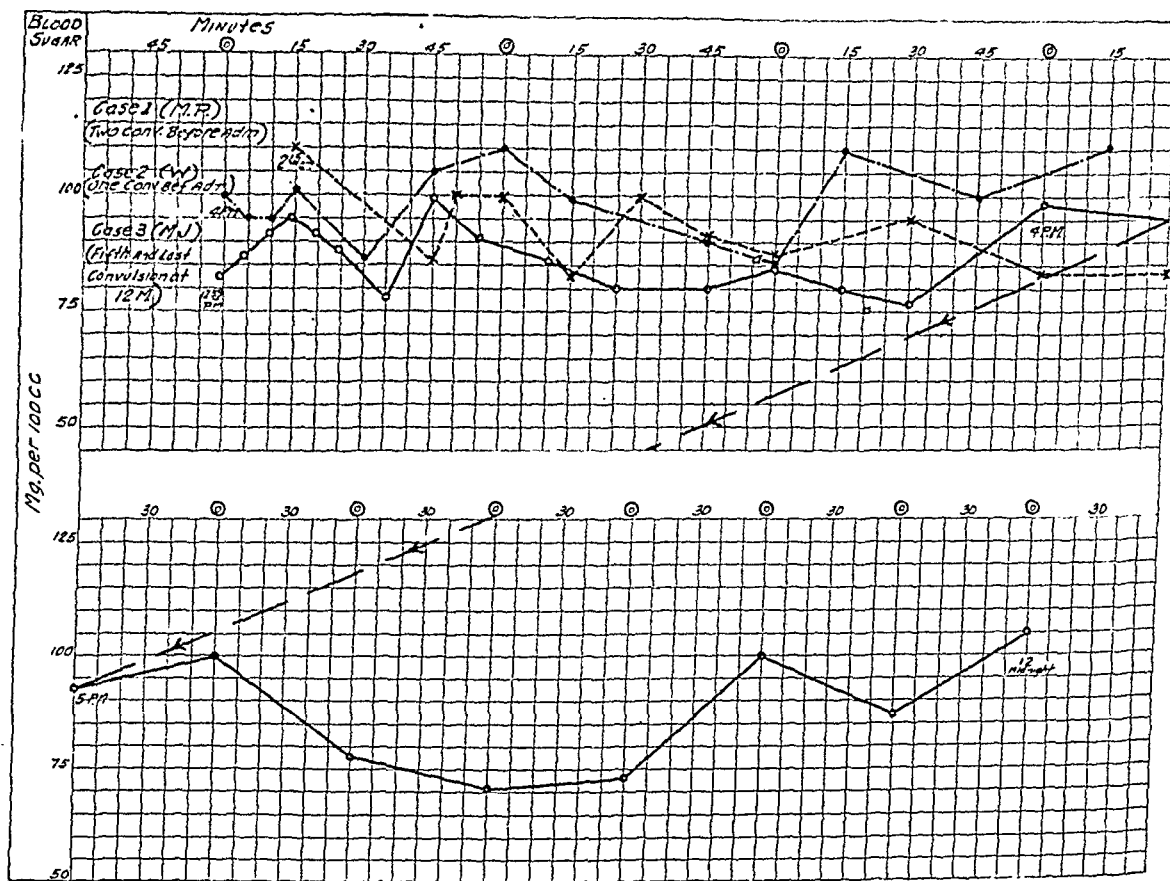


Chart VIII.—Cases illustrating persistence of fluctuations after convulsions have ceased.

*Case 1:* (Dotted line) Two convulsions before admission; none after admission. Initial level 110 mg., highest level 110 mg., lowest level 83 mg. sugar per 100 c.c. of blood.

Downward fluctuations fairly sharp but followed by quick recovery to higher and safer levels, without convulsions. Curve more nearly level and steadier toward end of study.

*Case 2:* (Dot and dash line) One convulsion before admission, none after admission.

Initial level 100 mg., highest level 111 mg., lowest level 87 mg. sugar per 100 c.c. of blood.

At point *a*, patient became twitchy, and a convulsion seemed imminent. Blood-sugar readings showed that this irritability was preceded by a fall in blood sugar, and was followed by a sharp rise. These results indicate that a convulsion had been narrowly averted.

*Case 3:* (Solid line) Fifth and last convulsion took place at 12 M., shortly after admission; blood-sugar series was begun one hour later and continued until midnight.

Initial level 83 mg., highest level 105 mg., lowest level 71 mg. sugar per 100 c.c. of blood.

In upper panel of chart each vertical line represents five minutes, in lower panel ten minutes. Specimens were taken more infrequently as time passed, and it was apparent that the patient's condition was improving.

No medication was given this patient during the time of this study, and it is obvious that she, like all eclamptic patients, was necessarily in a fasting state, since coma is an almost constant characteristic of the disease.

develop and prove such an idea, there is still no evidence to show that the fetus produces any toxin capable of causing eclampsia. Moreover, the occurrence of eclampsia with hydatidiform mole has been reported many times and not only serves to eliminate the fetus from responsibility but also to strengthen the carbohydrate deficiency theory. Such a mole is an enormous overgrowth of chorionic or placental tissue. Analysis of fetal tissues shows that the placenta exceeds all other fetal organs in its glycogen content<sup>24</sup> and to produce such a mass of chorionic tissue as represented by a mole must argue a glycogen deprivation elsewhere.

Dieckmann and Crossen<sup>25</sup> in their recent comprehensive work comment on the glycogen requirements incidental to the extremely rapid multiplication in the size of the fetus as pregnancy progresses as well as that due to the tremendous hypertrophy of the uterus. They conclude most logically "that systematic study of the metabolism particularly of the carbohydrates, \* \* \* will enlighten us more as to the etiology, pathology, and treatment than speculations concerning 'toxins' or deranged glandular function."

The occurrence of postpartum eclampsia would seem to eliminate both fetus and placenta from direct responsibility and may be explained as being an aftermath of their inordinate demands.

The fourth and fifth points are generally conceded and have been discussed elsewhere in this paper, while the sixth is the theme of this essay.

#### AUTHORITATIVE RELATED OPINIONS AND RESEARCH

Even at the risk of unduly lengthening this paper, it is necessary here to refer to and accredit the work of those investigators whose research has a bearing on these present studies.

Benthin<sup>26</sup> refers to Hofbauer's work on glycogen depletion of the liver cells, and says that "through these changes in liver tissue a disturbance in function develops . . . bearing on carbohydrate metabolism." He also says "the viewpoint that when disturbances in metabolism are observed, they must stand in some relation to the liver is as unassailable as the following: that with physiologic and pathologic changes in the liver tissue metabolic disturbances make themselves noticeable." He likewise noted that blood-sugar values in eclampsia showed an increase only when the blood was taken after a convulsion or between two convulsions, but he did not demonstrate the fall preceding the convulsion which we consider the essential motivating factor. In summarizing his beliefs he holds that a damaging disturbance of liver function is etiologically involved in the origin of eclampsia (*Eine Funktionsschädigung der Leber ätiologisch für die Genese der Eklampsie in Betracht zu ziehen*).

Opitz<sup>27</sup> notes the similarity between certain features of pregnancy toxemias and "hunger-diseases"; he speaks also of the similarity of the reactions in pregnancy to those observed in patients with large malignant growths and severe infections (increased antitrypsin in the blood, more rapid sedimentation of blood corpuscles, similarity in course of Abderhalden ferment reactions, alterations of cobra-venom hemolysis, the complement fixation, and the diminution of the colloidal protective action of the serum). He concludes that toxemia may be due to the following

combination: pregnancy to be compared to a rapid-growing malignant tumor, plus hunger through decreased intake of important nutritive elements, and that pregnancy toxemia is the result of disturbed metabolism resembling the various hunger-diseases more than any other group of conditions.

The relation between the glycogen content or depletion of the liver and the histologic changes has been referred to: Dudley and Marrian<sup>18</sup> found not only that insulin given to normal animals failed to accelerate the glycogen storage in the liver but rather that the livers of normal animals which had received sufficient insulin to bring them to the verge of hypoglycemic convulsions contain very little glycogen. Glycogen depletion is followed by fatty infiltration and disturbance of liver function. Barbour, Chaikoff, MacLeod, and Orr<sup>28</sup> of the Toronto group, who at first thought otherwise, now subscribe to this view.

Likewise, Mann and Magath<sup>29</sup> have repeatedly demonstrated that the most marked result of experimental extirpation of an animal's liver is a progressive fall in blood sugar. With its continued fall the expected symptoms of hypoglycemia develop as in "extirpation" of the liver glycogen by insulin, convulsions follow, and in one of them the animal dies. If, however, during any stage after development to the point at which respiration has actually stopped, glucose is injected, the animal immediately and completely recovers. This work appeared some time after our original theories and recommendations regarding the use of glucose injections in hyperemesis and eclampsia were first published, but has a remarkable relation to all that we then and now have to say.

Obata and Hayashi<sup>15</sup> in some experimental work with strychnine poisoning in animals demonstrated rises in blood sugar after the convulsions with remissions between them. They commented that similar conditions might prevail in eclampsia but failed to carry out to a conclusion such studies in eclamptic women.

Correlation of the foregoing with our own work makes it possible to deduce that: The needs of the fetus create a glycogen demand which with other factors previously referred to, accounts for the removal of glycogen from the liver; the histologic structure of the latter is changed in proportion to its depletion; this destruction of liver tissue becomes equivalent presently to its partial "extirpation"; carbohydrate metabolism is thereby affected; the blood-sugar values begin to seek hypoglycemic levels followed by frenzied efforts toward recovery thus initiating the fluctuating waves which have been noted in the curves of our charts; convulsions follow at certain low levels as the fluctuations become more and more violent, but like the familiar hypoglycemic convulsions these too can be controlled by glucose injections.

The usual nephritis of pre-eclampsia and eclampsia may be considered more or less of an incident, as it is in any profound disturbance of metabolism, or intoxication resulting from either a bacterial or a chemical poison. Similarly it will be remembered that nephritis occurs as the result of severe hyperemesis gravidarum, while in its more fulminating state, known as acute yellow atrophy of the liver, where the liver destruction is rapid and extensive, typical "eclamptic" convulsions often occur—still further evidence of relationship between these states. The underlying metabolic disturbances are strikingly alike. Preexisting chronic nephritis probably increases the patient's susceptibility to the development of "toxemia" during pregnancy, thus being a predisposing factor.

## LABORATORY PROCEDURES

Due precautions have been taken in the laboratory work to eliminate all possible sources of error. Obviously all blood specimens were taken on a "fasting" basis, since no woman in eclamptic coma is taking nourishment, and our normal controls were fasted overnight.

In certain of our earlier cases calcium oxalate was used as the anti-coagulant, and in these series if the examinations could not be made at once, the filtrate was prepared immediately and only then held for later examination. Since that time we have invariably used sodium fluoride (10 parts) and thymol (1 part), which combination prevents deterioration of blood-sugar values. As the serial readings were made, new standards were prepared for every six specimens which were done at one time.

## EFFECT OF THESE STUDIES ON THE USE OF INSULIN IN PREGNANCY TOXEMIAS

Endogenous insulin production is supposed to fluctuate in response to food intake or to abstinence from food.

It has been shown<sup>30</sup> and confirmed<sup>31, 32</sup> that insulin production in a normal individual is stimulated by intravenous injections of glucose solution. Thalhimer and others<sup>33</sup> have also demonstrated that this can be carried to such an extreme of overstimulation as to produce the following apparently paradoxical situation: the intravenous injection of a continuous stream of glucose solution at a slow rate over a certain period of time causes blood sugar first to rise, then steadily to fall as the pancreas responds to the injection by increased insulin production, this fall continuing to such a low level in spite of the constant inflow of glucose that presently symptoms of hypoglycemia manifest themselves and blood-sugar readings correspond to those seen in insulin overdosage. We would comment that for this hypoglycemia there is no antidote, and these findings emphasize our earlier contention that for therapeutic purposes single large injections of glucose solution repeated at stipulated intervals are preferable to continuous injections over any considerable period of time.

In a woman with toxemia of pregnancy whose insulin producing ability is supposedly unimpaired even though temporarily in abeyance as the result of a carbohydrate deficiency, the mere injection of glucose is sufficient therefore to stimulate her pancreas in this respect. If it be conceded that her insulin production is temporarily restricted, it must be remembered that this is a response in a normal physiologic way to the temporary deficiency in carbohydrates and thus is a protective measure.

If Nature responds to the glucose injection with an overdose of endogenous insulin, every unit injected by a hypodermic syringe becomes a still greater overdose if the woman is, as we suppose, not a diabetic.



The rationale of adding insulin to intravenous injections of glucose for nondiabetic intoxications and acidoses is not consistent, and now that we have demonstrated a disturbance in carbohydrate metabolism with hypoglycemia (the opposite of diabetes) it is obvious that this procedure is contraindicated.

Those cases in which benefit has been reported from the combination of glucose and insulin were possibly accelerated momentarily by the extra insulin, but the benefit was derived from the excess of glucose (overprotection) rather than from the injected insulin. Glucose alone would have been safer, while with the pancreas normal as it undoubtedly was, the injected insulin was unnecessary. Each succeeding glucose injection stimulates the endogenous insulin production to further and further activity, so that the addition of insulin to subsequent injections becomes increasingly dangerous.

The suggestion of Stander and Duncan previously referred to; namely, that insulin alone or with merely a "protective dose of glucose" should be given to eclamptics even in the absence of blood-sugar readings was undoubtedly the outgrowth of Thalheimer's<sup>34</sup> addition of insulin to the glucose therapy of the disease.

This use of insulin in pregnancy toxemias has been vigorously opposed by Titus,<sup>35</sup> by Harding,<sup>36</sup> and recently by Bokelmann,<sup>37</sup> of Berlin. MacLeod and Campbell<sup>38</sup> also disapprove of insulin being added to glucose in the treatment of acidosis resulting from this and all other nondiabetic states.

The interesting thought had occurred to us in the course of this study that an overproduction of maternal insulin from some unknown cause might have a bearing on the etiology of hyperemesis, since in these cases there is usually a hypoglycemia (to be published in later report), and that the development of the fetal pancreas with its own insulin production might play a rôle in the etiology of eclampsia. These ideas have been discarded, however, for the more reasonable "carbohydrate deficiency theory" as originally outlined. There is no evidence to warrant the idea that the maternal pancreas becomes overactive in early pregnancy, and in hydatidiform moles with eclampsia there is no fetal pancreas.

#### CONCLUSIONS REGARDING TREATMENT OF PREECLAMPSIA AND ECLAMPSIA

For preeclampsia the usual rational procedures (restriction of salt and of protein intake, rest, attention to bowels and kidneys, etc.) are to be vigorously utilized, and in view of the disturbance in carbohydrate metabolism now demonstrated, increased carbohydrate intake should immediately be instituted. These patients do not need intravenous injections of glucose, because they are able to take and retain food by mouth. A diet high in carbohydrates is essential for preeclampsia, therefore, and glucose solution with fruit juices should be one of its features.

The so-called conservative treatment of eclampsia, advocated by Stroganoff, by Tweedy of the Rotunda school, and by Williams, has by its lowered mortality rates thoroughly proved its value over the practice of undertaking active interference and immediate operative delivery of the fetus during eclampsia.

As a result of our studies we believe that a reasonable basis is now established for what have been empirically successful methods. With these findings in mind we wish to outline the therapeutic procedures which now seem essential in the treatment of eclampsia:

First, the administration of morphine by hypodermic injection, or of magnesium sulphate (Lazard<sup>39</sup>) by hypodermic or intravenous injection, and of chloral hydrate by rectum. Each of these drugs is of value in eclampsia, although they differ somewhat in their general effect. Their sedative action checks the convulsions and by producing absolute muscular rest and relaxation, the patient is afforded an opportunity to restore her metabolic equilibrium.

The action of morphine is prompt, but the effect is less lasting than magnesium sulphate. Chloral has an advantage over morphine for continued use during the later hours of the first day or two of an attack (after convulsions have subsided) in that its by-effects are less obnoxious. Magnesium sulphate (intravenously) has an effect in addition to its sedative action, according to Lazard, of reducing cerebral edema and of stimulating elimination.

Second, the intravenous administration of hypertonic glucose solution in single doses of 75 gm. in 300 c.c. of water (25 per cent solution) at the rate of not more than 1 gm. per minute, or from an hour and a quarter to an hour and a half for the entire injection. This should be repeated after intervals of four or five hours during the attack and for a time following cessation of the convulsions (three or four times in first twenty-four hours, according to the needs and response of the patient) until fluids can be taken freely by mouth.

The symptomatic treatment of the eclamptic convulsions having been accomplished by the sedatives, the use of glucose is directed toward the underlying cause of the disease. It is antidotal to the hypoglycemia; it has a liver-sparing effect, restoring glycogen depletion of the liver, and it furnishes both glucose and water to the tissues.

The immediately noticeable effects are diuresis, lowering of blood pressure directly following the injections, cessation of the convulsions, and the prompt regaining of consciousness. The odor of acetone quickly disappears from the breath, and edema lessens rapidly after the injections.

Interference with pregnancy is to be undertaken only according to the present tenets of the "conservative" treatment. If labor supervenes, the patient is to be delivered, preferably by forceps in the

second stage (nitrous oxide and oxygen, or ether anesthesia) with as little disturbance to her as possible. If labor does not begin during the eclampsia, all attempts at operative interruption of the pregnancy are interdicted until at least hours and preferably days have elapsed following the cessation of the convulsions. In a certain percentage of instances pregnancy may be allowed to continue, in others the patient's condition makes it necessary eventually to interfere by induction of labor.

A curious fact which we have observed during the past few years of work on this subject is the decreasing frequency of eclampsia. Prenatal care seems to be steadily diminishing its incidence, although this alone cannot be expected entirely to stamp it out, but in the larger centers it is being seen more and more infrequently. This opinion represents a fairly general survey because in Pittsburgh many of our obstetrician friends agreed to cooperate in this work and to call us to their hospitals whenever a case appeared. However, the cases were so limited in number that two of us (Titus and Dodds) on different occasions made this the excuse for fairly protracted stays in New York and Chicago where we supposed the very size of the cities would make for a plentiful number of cases. Even there we found the same general condition prevailing.

It is a splendid commentary on the spirit of cooperation in our profession toward work of this sort that in these two large cities our many friends without a single objection agreed and arranged to make available to us for study any cases they had, without any more than the mere assurance that this was a carefully planned investigation.\*

It is also satisfactory to relate that with but one exception every patient on whom these studies were made recovered from her eclampsia. This one patient lived for twelve days after recovering from the eclamptic seizure and then died with symptoms of intracranial hemorrhage and meningitis. It was apparent, therefore, that no undue risks were taken with these patients by carrying out this study.

No conclusions as to mortality rates should be drawn from any but large series of cases, but with these present methods of treatment the admission of a patient with eclampsia to our hospital service is now viewed with considerable equanimity rather than with the alarm which such a condition formerly aroused.

We desire to express our appreciation to those who have been of assistance to us in the laboratory work connected with this study: Mr. Nerses, Dr. Edmund Smith, and Dr. Wiener of New York, Dr. Sarraff, Dr. Tefft, Miss Fichtel, and Miss Egbert, of Pittsburgh.

\*Our most cordial thanks are due those who wished to help us as well as to those who did provide us with cases.

(In New York: Drs. Humpstone, Matthews, Brodhead, Watson, Caldwell, Kosmak, Hildreth, Ryder, Harrar, Davis, Polak, Williamson, Beach, Rongy, Kassebohm, and Pierson.

In Chicago: Drs. DeLee, Greenhill, Culbertson, Hillis and Lewis.  
In Pittsburgh: Drs. Dunlap, Wechsler, Calvin Marshall, Langham, McCombs, Kistler, Snyder, Gillis, Nealon, Baumann, Carroll, Bennett, Luke and W. N. Marshall.)

## CONCLUSIONS

1. Evidence is now offered to demonstrate that in eclampsia the disturbance in carbohydrate metabolism, heretofore assumed, actually exists.

2. This disturbed metabolism is apparently the result of the carbohydrate deficiency in pregnancy which we have previously postulated.

3. Contrary to the general opinion, hyperglycemia is not characteristic of eclampsia.

4. Serial blood-sugar readings during an attack of eclampsia show wide fluctuations in exceedingly short intervals of time. Similar series in normal pregnant women near term show no such variations. Graphs of such glycemia curves are shown to substantiate the foregoing statement.

5. The convulsive seizures occur at levels which we have designated as "relative hypoglycemia," and apparently are caused by the sudden drops in blood sugar now being reported. In this respect eclamptic convulsions are comparable to those of insulin hypoglycemia.

6. Following a convulsion, there is usually a temporary rise in blood sugar, the customary physiologic response of the liver to muscular activity.

7. There exists a tendency toward remissions to lower levels so that the general trend of the sugar content of the blood in eclampsia is downward, obviously the effect of exhaustion of reserve glycogen stores in the liver.

8. As a result of this and previous studies of toxemic disturbances of pregnancy, we are led to conclude (1) that there is a relationship between all toxemias of pregnancy, (2) that the difference between the hepatic lesions of the various clinical states is less distinctive than has been generally supposed, (3) that there is no specific toxin of fetal origin responsible for these toxic states, (4) that the various toxicoses of pregnancy, particularly eclampsia, are due entirely to disturbance in maternal metabolism, and (5) that this disturbance is one of carbohydrate metabolism, based primarily on a deficiency in carbohydrate intake plus increased consumption of carbohydrates which results in a depletion of the glycogen stores with consequential damage to the liver and its functions.

9. This glycogen deficiency in the liver presently becomes equivalent to its partial "extirpation"; the blood-sugar values begin to seek hypoglycemic levels followed by frenzied efforts toward recovery, thus initiating the fluctuating waves noted in our charts; the convulsions which occur at certain low levels as the fluctuations become more and more violent are controllable, like the familiar hypoglycemic convulsions, by glucose injections.

10. The nephritis of preclampsia and eclampsia, as well as of grave hyperemesis, is not the forerunner but an incidental symptom and result of the intoxication.

11. The insulin production of a nondiabetic pancreas may be temporarily in abeyance during a pregnancy intoxication as a physiologic response to the lessened glycogen reserve in the body. Such a pancreas should respond to an injection of glucose as does any normal pancreas, by an overproduction of endogenous insulin so that any additional insulin injected is an additional overdose.

12. With the view that the convulsions of eclampsia are to be designated as a hypoglycemic reaction or manifestation, the use of insulin either with or without glucose in the treatment of this disease is unnecessary and contraindicated.

13. Appropriate treatment for eclampsia as established by these glycemia-curve studies consists of two main features (a) complete muscular rest and relaxation as induced by quiet, isolation, and the use of morphine by hypodermic injection, chloral hydrate by bowel, and magnesium sulphate by hypodermic or intravenous injection, and (b) the intravenous injection of strongly hypertonic glucose solution. It is urged that the prevalent underdosage be avoided and sufficient glucose in sufficient concentration be given to produce a full therapeutic effect.

14. The statement made in earlier communications is reiterated here that the therapeutic dose of glucose for an adult is a minimum of 50 to 75 gm. in 200 to 300 c.c. of distilled water respectively (25 per cent solution) given by intravenous injection over a period of not less than one hour and repeated after intervals of from four to five hours according to the needs and response of the patient.

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1015 HIGHLAND BUILDING.

(For discussion, see page 442.)

## THE PLACE OF THE VAGINAL CESAREAN SECTION IN OBSTETRICS

BY LOUIS E. PHANEUF, M.D., F.A.C.S., BOSTON, MASS.

DÜHRSSSEN, in 1890, recommended the use of deep incisions in the anterior or posterior lips of the cervix, or both, but avoiding the lateral portions, in order that the deep, irregular cervical lacerations which are likely to follow a rapid delivery through a rigid undilated cervix might be avoided. It was soon discovered, however, that the incisions did not reach high enough to overcome the resistance of the internal os, that extensive tears which were difficult to suture were likely to follow, and that hemorrhages which were hard to control sometimes occurred.

Realizing that his incisions in the cervix did not enlarge the canal sufficiently for immediate delivery, Dührssen devised the operation which, in 1895, he described as an anterior vaginal hysterotomy, and in 1896 called "vaginal cesarean section." The original operation called for only the anterior incision; later, he modified the technic by adding the posterior incision. The result of this was that it enabled him to make a shorter anterior incision, thereby lessening the danger of injury to the bladder during delivery.

Before attempting vaginal cesarean section, certain requirements are essential. The tissues must not be edematous or friable. The uterus must be movable so that the cervix may be readily brought down into the vagina. The pelvis must be ample. The child must not be too large. In the absence of these requisites, the vaginal cesarean section should not be considered, regardless of the indication.

## INDICATIONS AND CONTRAINDICATIONS

The literature of the last ten years contains very little about vaginal cesarean section. The great advantage of this method is its extra-peritoneal approach of the uterus; therefore, the marked increase in safety over the classical operation. Since the more general adoption of the suprasymphyseal or transperitoneal low abdominal cesarean

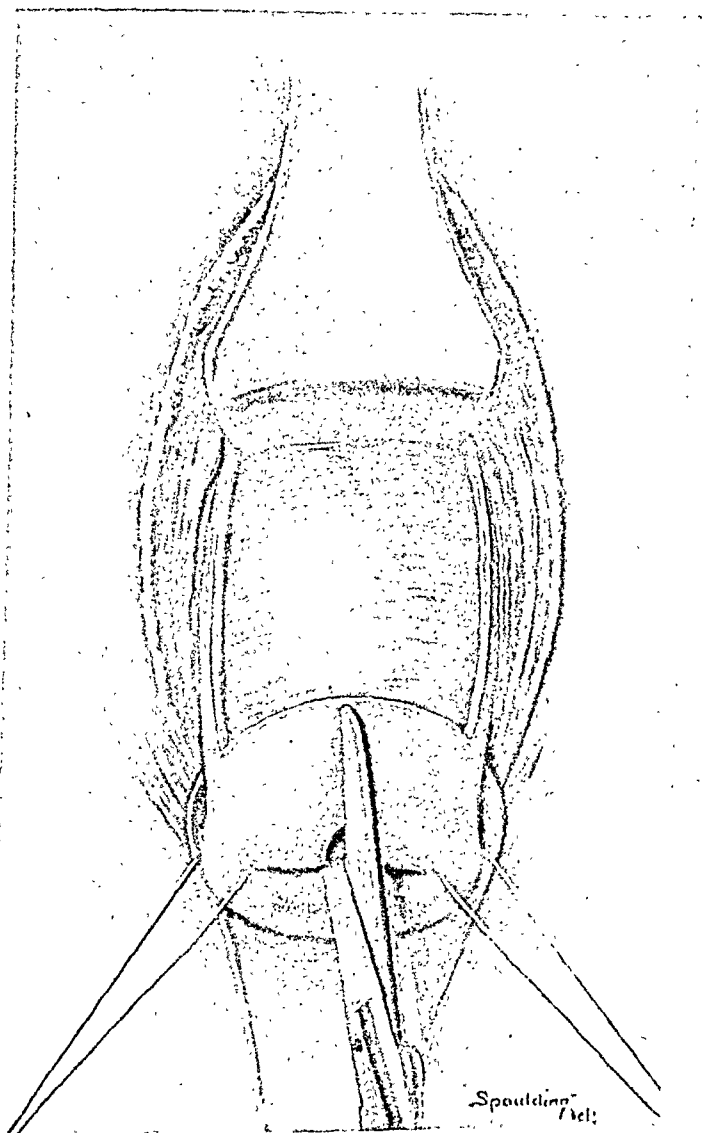


Fig. 1.—Vaginal cesarean section. The cervix is brought down by volsella. A traction suture of heavy chromic catgut is placed at each lateral angle. A transverse incision, in the anterior vaginal wall, is made at the point of attachment of the bladder to the cervix, and the bladder, together with the vaginal wall, is dissected upwards to the reflection of the anterior peritoneal culdesac. The bladder is held under a retractor, and the cervix is incised in the median line.

section, it has been found that the increased protection against infection secured by this procedure is almost as great as that of vaginal hysterotomy. For this reason, and also because of the simpler technic,

the low abdominal operation has been substituted for the vaginal in a number of clinics. This has tended further to limit the indications of vaginal hysterotomy.

Dührssen advised his operation for the following conditions:

1. *In the anomalies of the cervix and of the lower uterine segment creating some difficulties which place the mother in danger, including cancer, myoma, ovarian tumors, and stenosis of the cervix.*

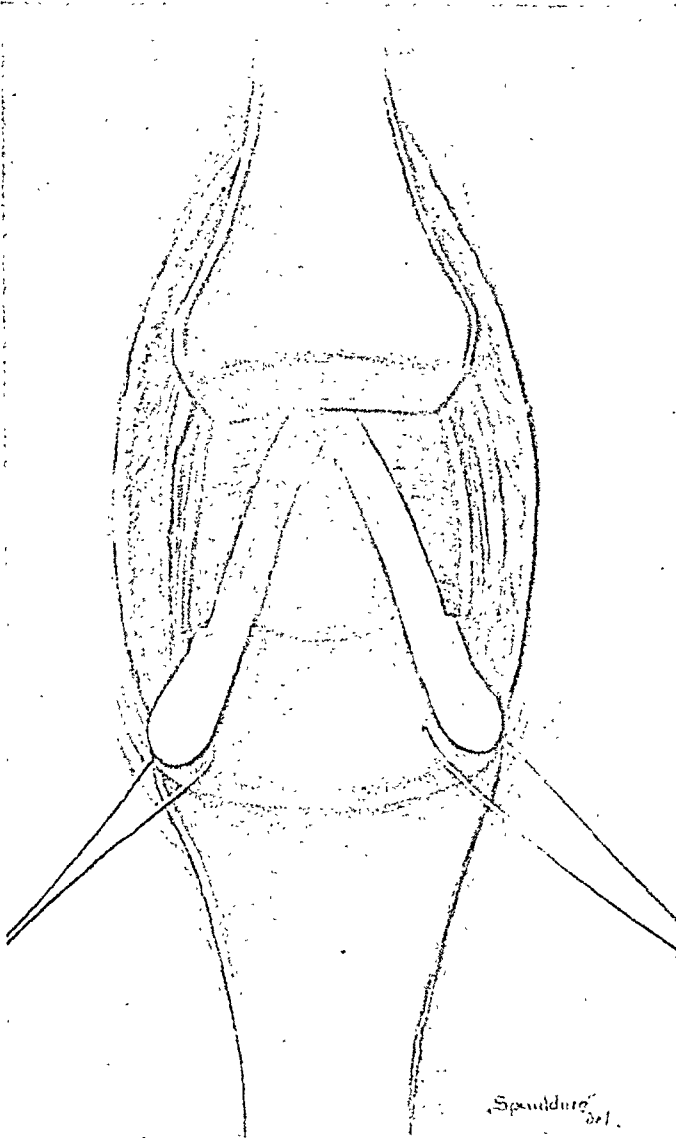


Fig. 2.—The cervix has been incised anteriorly. The membranes are shown through the incision.

2. *When the mother is in danger and when the rapid evacuation of the uterus is indicated to improve the general condition. Lesions of the heart, lungs, kidneys; eclampsia; premature separation of the normally inserted placenta.*

3. *When the mother is dead or dying.*

4. *When only the infant is in danger, as in a slow labor and in compression of the cord.*



At the present time, while vaginal cesarean section is still recognized as a valuable procedure, most obstetricians would not subscribe to the original indications, and its range of usefulness has become much more limited.

*Group I.*—Stenosis of the cervix remains an accepted indication. A labor complicated by myomas and ovarian tumors, however, is best terminated by an abdominal delivery followed by the ablation of the

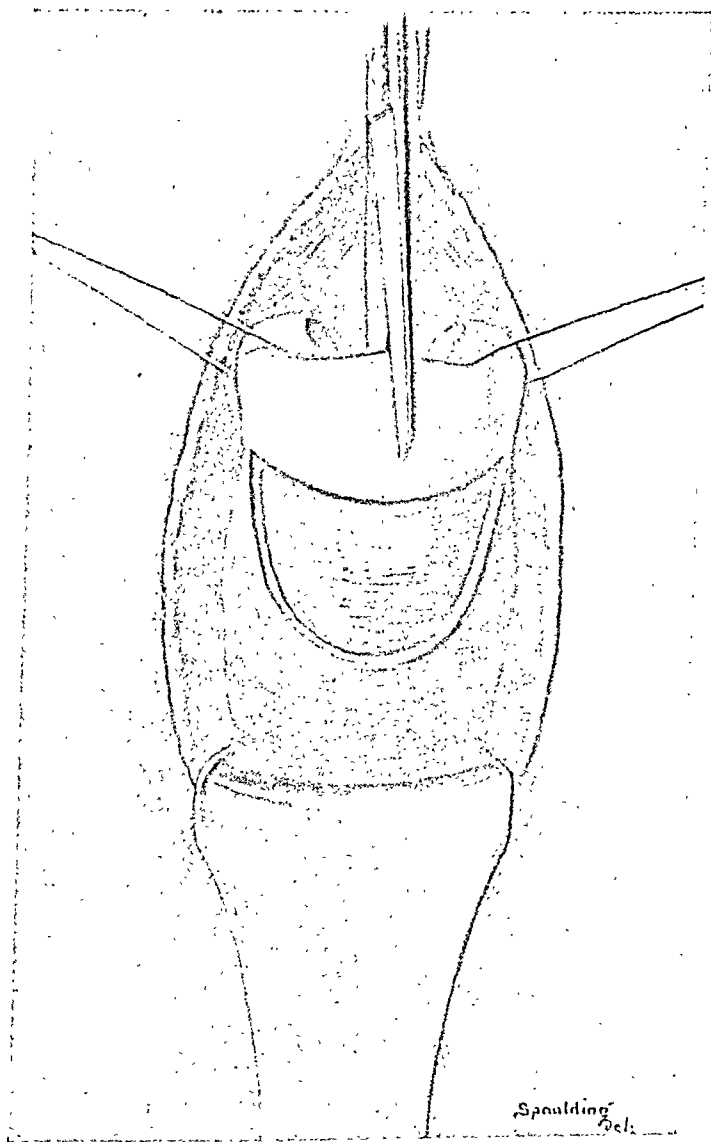


Fig. 3.—The posterior lip of the cervix is pulled upward toward the symphysis. A transverse incision is made at the junction of the vagina and cervix. The posterior culdesac and the rectum are reflected downward, and the posterior lip is incised as far up as possible, care being taken to respect the abdominal cavity.

tumor in question, or even hysterectomy in the case of multiple myomas. In cervical carcinoma, if the extension of the lesion is limited, and the patient is in good physical condition, delivery should be accomplished by the abdominal route and followed by the total extirpation of the uterus and its adnexa. In the more advanced cases de-

livery by a fundal cesarean section followed by implantation of radium in the cervix and by deep x-ray therapy may prove to be the most successful method. The frequent extension of the neoplasm toward the bladder will complicate the separation of the vesicouterine culdesac and present the risk of incising a lower segment which is edematous, infiltrated, inelastic, and which does not furnish the passage that is necessary for a successful delivery.

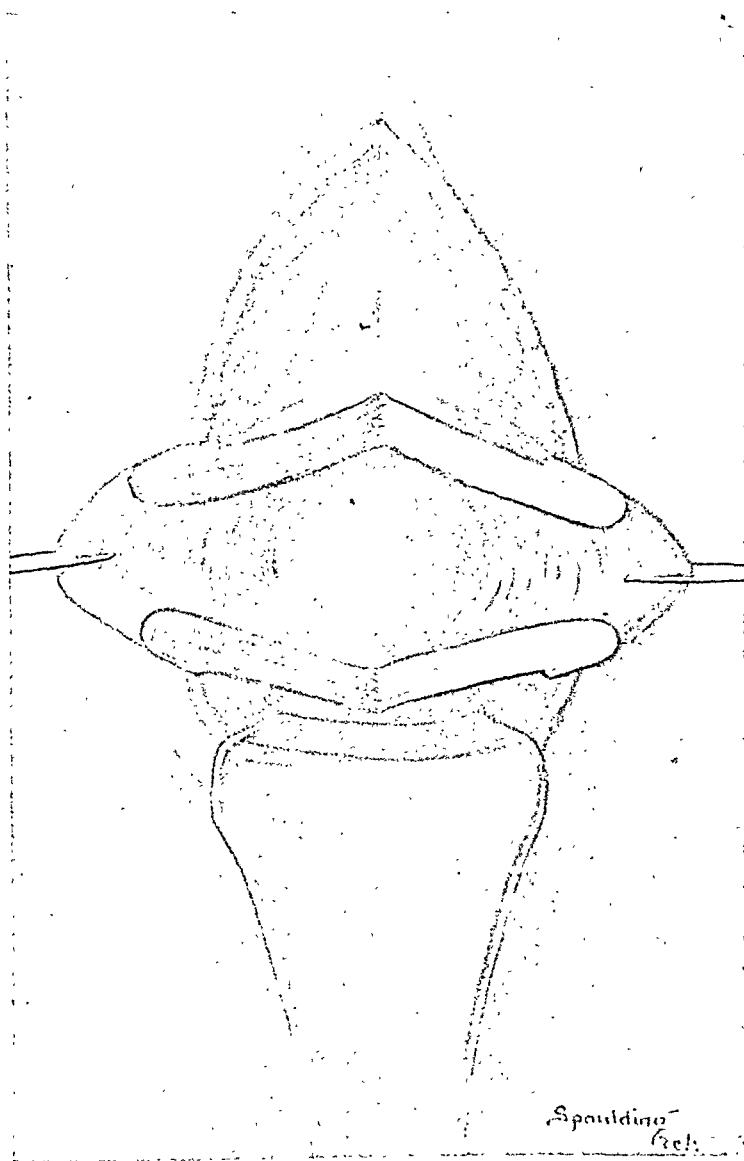


Fig. 4.—Anterior and posterior cervical incisions have been made. The delivery and extraction of the placenta and membranes follows.

*Group II.*—Lesions of the heart, lungs, and kidneys are still looked upon as suitable indications. As far as eclampsia is concerned, opinions are divided, but most obstetricians, nowadays, favor the Stroganoff conservative treatment or some modification of it, rather than the emptying of the uterus during convulsions. The vaginal cesarean section, nevertheless, is of marked value in the toxemic pa-

tient who fails to improve under the conservative treatment and when convulsions are imminent, since most gravidæ delivered before the onset of convulsions have a much better chance of recovery. Vaginal hysterotomy is one of the accepted methods of terminating pregnancy in such cases. Premature separation of the normally inserted placenta in its milder forms and where no cervical dilatation exists may be treated successfully by vaginal cesarean section, but since we recog-

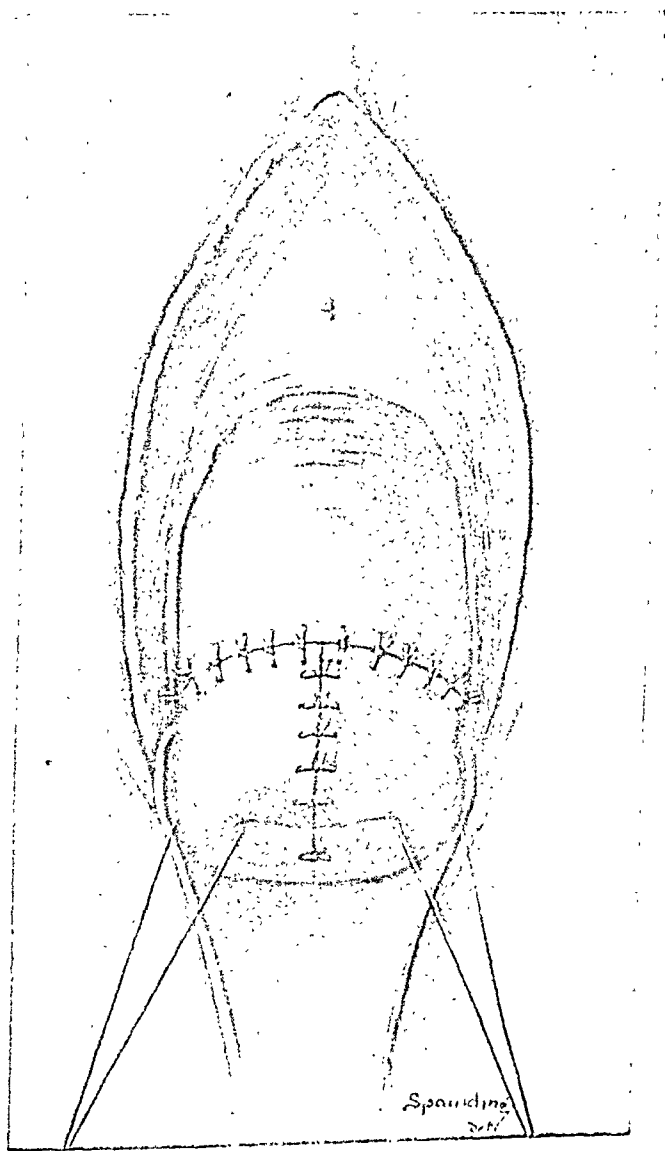


Fig. 5.—The cervical incisions have been closed with interrupted sutures of No. 2 chromic catgut, likewise the edges of the vaginal incisions.

nize more and more the association of uterine apoplexy in the severe forms of this condition, abdominal delivery with the conservation or the sacrifice of the uterus, depending upon the extent of the lesion, seems to be the better form of treatment.

*Group III.*—When the mother is dead or dying, I personally can see no reason for doing an operation, the technic of which is as complicated

as vaginal cesarean section, when the abdominal method which is quicker and simpler cannot in any way jeopardize the mother's chances and will certainly do a great deal more for the baby, the only reason for operating in this type of case.

*Group IV.*—When only the infant is in danger from a slow labor and from compression of the cord, vaginal cesarean may be indicated if the child is premature. At full term, the abdominal section is the preferable operation of the two.

Placenta previa is one of the obstetric complications for which vaginal hysterotomy has been recommended. The literature shows that this procedure has been employed, with success, in a number of cases of low implantation of the placenta. However this may be, the majority of operators would not agree that placenta previa is an indication for vaginal cesarean section for the following reasons: the hemorrhage of placenta previa added to the blood loss which may occur during the operation might well enough be fatal; the operation is not as rapid and as simple as abdominal section, and lastly, the hemorrhage from placenta previa would so obscure the field as to add materially to the difficulties of the procedure. In view of these reasons abdominal cesarean section should be chosen in central and in some cases of partial placenta previa, and a more conservative method, such as the insertion of a Voorhees' bag, or Braxton-Hicks version in the marginal variety.

Vaginal hysterotomy may be performed at the full term of pregnancy. I have personally so delivered a woman who had reached term with a good result; however, it offers no advantages over the low cervical cesarean section with a mature child, and I feel now that after the eighth month of pregnancy the large fetal head may extend the incisions and add materially to the risk of injuring the bladder. For this reason, it is my custom to resort to the abdominal cervical cesarean after the eighth month of pregnancy when an indication for immediate delivery arises.

A previous cervical cesarean section may seriously complicate the technic of the vaginal operation, since the bladder is much more adherent than in the normal condition. The anterior peritoneal culdesac having been obliterated, a definite interference with the rising of the bladder in the abdominal cavity exists during delivery and thereby predisposes to the laceration of this organ by the fetal head.

Vaginal cesarean section, therefore, finds its largest field of usefulness when an indication for the rapid emptying of the uterus arises up to the end of the eighth month of pregnancy, in:

1. Lesions of the heart, lungs, and kidneys.

2. Toxemia of pregnancy in the presence of impending convulsions and in gravidæ who did not improve under the conservative treatment.

3. Pernicious vomiting of pregnancy in a gravida who is dehydrated and exhausted and who would not stand a long labor.

4. Premature separation of the normally inserted placenta in its milder forms.

#### TECHNIC OF OPERATION

A weighted speculum is introduced in the vagina to expose the cervix. The cervix is brought down by means of two volsellas, one at each lateral angle, and dilated with Hegar dilators to assure drainage. A suture of chromic catgut is placed at each lateral angle of the cervix and left long. These sutures facilitate the bringing down of the cervix after delivery. If the cervix is not readily brought down by this method, a No. 4 Vorhees' bag is introduced into the uterus; it is filled with 1 per cent lysol solution, and is used as a tractor. A transverse incision is made in the anterior vaginal wall at the point of attachment of the bladder to the cervix, and the bladder together with the vaginal wall is dissected upward to the reflection of the anterior peritoneal culdesac. The bladder is never separated from the vaginal wall, as is illustrated in most textbooks, because this has been found unnecessary and predisposes to bleeding and injury to the hyperemic and friable vaginal wall.

The bladder is now held under the symphysis by means of a wide retractor, and the anterior lip of the cervix is incised up to the vesicouterine culdesac, care being taken not to enter the peritoneal cavity. The posterior lip of the cervix is pulled upward toward the symphysis, with volsella or the bag, as the case may be, and a transverse incision is made at the junction of the vagina and the cervix. The posterior culdesac and the rectum are reflected downward, and the posterior lip is incised as far up as possible, care being taken to respect the abdominal cavity.

The instruments are now removed and the hand is introduced into the uterus, an internal podalic version and a breech extraction are performed in the usual way, and the placenta and membranes are extracted manually. By injecting pituitary extract and an aseptic preparation of ergot, the bleeding is usually controlled, so that packing is rarely necessary.

The cervical incisions are closed with interrupted sutures of No. 2 chromic catgut; the vaginal incisions are sutured in the same manner with the same material.

When the fetus is small, it is not necessary to incise the cervix posteriorly, as the anterior incision usually gives enough room for its extraction.

#### AUTHOR'S SERIES OF VAGINAL CESAREAN SECTIONS

TABLE I. NUMBER OF PREGNANCIES

Para i	17	
Para ii	2	
Para iii	5	
Para iv	2	
Para v	1	
Total		27

TABLE II. PERIOD OF GESTATION

Full Term	1	
8 months	4	
7½ months	3	
7 months	11	
6½ months	4	
6 months	1	
5½ months	1	
5 months	1	
4 months	1	
Total		27

In the four cases where the period of gestation had not reached six and a half months, or the period of viability, the fetuses were macerated. In the case of one of the gravidæ the pregnancy had been carried the fullterm, although she was delivered of a five months' macerated fetus.

TABLE III. INDICATIONS

Toxemia of Pregnancy, Convulsive Type	6
Toxemia of Pregnancy, Nonconvulsive Type	5
Toxemia of Pregnancy, Pernicious Vomiting Type	3
Toxemia of Pregnancy, Ablatio Placentæ	2
Toxemia of Pregnancy, Pyometra-Rigid Cervix	1
Toxemia of Pregnancy, Previous Nephrectomy—Retained macerated fetus, Eighth month of pregnancy	1
Chronic Nephritis and Pregnancy	1
Pulmonary Tuberculosis, Advanced	1
Mitral Stenosis and Regurgitation, Pyelitis	1
Congenital Pulmonary Stenosis	1
Hydramnios, Rigid Cervix	1
Rigid Cervix, Long Labor	2
Pyelitis	1
Attempts at delivery before admission for hemorrhage, 6½ months of Pregnancy. Dead Fetus. Contracted Uterus	1
Total	27

TABLE IV. INDUCTION OF LABOR BEFORE VAGINAL CESAREAN SECTION

Induction with the Voorhees bag	5
Induction with cervical and vaginal gauze pack	1
Induction with bougies	1
Total	7

In these 7 cases, although contractions started, the cervix did not dilate, and as the patients became gradually worse, the labor was terminated by vaginal hysterotomy.

TABLE V. CERVICAL INCISIONS—EPISIOTOMY

Anterior Incision	12
Anterior and Posterior Incisions	15
Episiotomy performed 5 times	

TABLE VI. MATERNAL RESULTS

Maternal Recoveries	26
Maternal Death	1
Maternal Mortality	3.7%

TABLE VII. FETAL RESULTS

Macerated Fetus	9
Stillborn Fetus	8
Lived 24 hours or less	6
Lived one month	1
Now alive	3
Total	27
Total fetal Mortality	88%
If we exclude the 9 macerated and 8 stillborn fetuses	37%
Naturally these infants with one exception were markedly premature and toxic.	

TABLE VIII. PELVIC DELIVERIES FOLLOWING VAGINAL CESAREAN SECTION

1 patient had a normal delivery in the hospital.  
 1 patient had a normal delivery in her home by another obstetrician.  
 1 patient had a version and breech extraction after twelve hours of labor and subsequently a normal delivery.  
 All these mothers and children are well.

In this series of twenty-seven operations, one mother died. Mrs. A. K., para i, thirty-one years of age, was seen for the first time on April 27, 1919. She had been admitted to a hospital during a severe hemorrhage due to the premature detachment of a normally inserted placenta. The cervix was not taken up, and there was no dilatation. Her pulse was 120 in rate, thready, and of poor quality. The vertex was presenting in left occipitoanterior position. An immediate abdominal delivery was decided upon on account of the hemorrhage and the long rigid cervix without dilatation. On opening the peritoneal cavity, a rent about two inches long running obliquely from the fundus toward the right tube was noticed; this extended through the serosa and muscularis, but not through the mucosa. There was considerable blood, both free and clotted, in the peritoneal cavity. The uterus was incised in the median line, there being practically no bleeding from the cut uterine wall. The placenta was almost entirely separated. A small stillborn male fetus, at term, was extracted by the breech; the placenta, membranes, and clots were removed, and the cervix was dilated from above. The uterine incision was sutured in two layers with No. 2 chromic catgut. The rupture in the uterus was repaired with figure of eight sutures of the same material. No attempt was made to remove the blood or fluid from the abdominal cavity, and the abdomen was closed in layers.

She had an uneventful convalescence and was discharged from the hospital on May 23, 1919, on the twenty-sixth day after operation.

Her second pregnancy evolved normally and on March 28, 1921, she was delivered of a normal female child, presenting by the breech in right sacroanterior position, by a low cervical cesarean section. At this time it was found that the previous incision and the rent in the uterus was well healed.

The patient was in poor physical condition throughout her third pregnancy. She had reached the full term, although her uterus corresponded in size with a five months' pregnancy. On August 16, 1924, she developed uterine hemorrhages and a septic purpura. She had shown signs of toxemia during the whole of her pregnancy. As she was failing rapidly, it was thought that her only chance rested in quickly emptying the uterus. This was done by vaginal cesarean section on August 16, 1924. Pyometra was found to be present, half a liter of foul pus being evacuated from the uterus as well as a macerated, five months' female fetus. There was no difficulty with the operation, which was rapid. The patient was returned to her bed in poor physical condition. She died three hours later from shock, toxemia, and severe uterine infection.

#### CONVALESCENCE

Of the twenty-six mothers who recovered, twenty-five had a satisfactory puerperium. The twenty-sixth puerpera made a good recovery, but her convalescence was complicated by a vesicovaginal fistula, which is still present and which I hope to repair in the near future. The history of her case follows:

Mrs. M. R., a primipara, twenty eight years of age, was admitted to the Gynecological and Obstetrical Service of the Carney Hospital on November 25, 1923, as an emergency case. Her family history showed nothing abnormal. Her previous history elicited that she had had measles, pertussis, and influenza. Her menstrual history was normal. On admission to the hospital at 3:30 P.M., it was found that she had been in labor for forty-eight hours. She complained of headache, nausea and vomiting, marked swelling of her hands and feet, and shortness of breath. She had been examined vaginally in her home a number of times; the exact number of examinations could not be ascertained.

On examination, the heart showed the typical signs of pulmonary stenosis, that is, a thrill and a systolic murmur heard to the left of the sternum in the second intercostal space; the pulmonary sound was replaced by a diastolic murmur; there was hypertrophy of the right heart and marked edema of the bases of the lungs. Considerable edema of the extremities existed, otherwise the physical examination was negative. She was pregnant at term, with the vertex presenting in right occipitoposterior position. On rectal examination, the cervix was found to be two fingers dilated, and the fetal head was overriding the symphysis. The patient was exhausted, and her condition looked desperate. She was delivered by a low cervical cesarean section, under morphine-scopolamine local anesthesia, of a living female child, weighing eight pounds and one ounce.

The convalescence was surprisingly simple; she had a temperature of 101° F. on the tenth postoperative day; otherwise the temperature remained below 100°. The highest pulse rate was 108. She was discharged on the fifteenth day after operation.

She was followed at the prenatal clinic of the Carney Hospital during her second pregnancy. Her confinement was expected on April 8, 1926. She complained of severe dyspnea, was markedly cyanosed, and had to sleep in a chair, as it was impossible for her to lie down. She entered the service on March 9, 1926, in what appeared to be a very serious condition. She had all the signs of extreme cardiac decompensation. On March 11, 1926, she was delivered of a male child weighing seven pounds, by a second low cervical cesarean section under scopolamine-morphine local anesthesia. Her cardiac condition gave considerable alarm during the puerperium, but her temperature never rose above 101° F. She had a sinking spell on March 28, and hopes for her recovery were almost abandoned. Nevertheless, she was discharged on April 4, 1926, on the twenty-fourth day after operation.

She showed signs of cardiac distress very early in her third pregnancy, but with rest in bed and proper medical treatment her gestation reached the seventh month. On May 19, 1927, she collapsed in the clinic where she had reported for a prenatal visit and was immediately sent to the hospital where she was kept in bed until May 23, 1927, the day of operation. Since her cardiac reserve was very low, it was thought that delivery by vaginal cesarean section would offer a better chance than would an abdominal delivery, since the added shock of opening the peritoneal cavity, slight though it may be, might result fatally. She was, therefore, delivered by vaginal hysterotomy under spinal anesthesia, anterior and posterior incisions being made in the cervix. There was no difficulty in separating the bladder. The delivery was accomplished by means of version and extraction of a stillborn male child. The head was soft and showed early signs of maceration. The bladder was injured during the delivery but was repaired immediately. A Pezzer catheter was introduced, and she was returned to her bed in fair condition. She convalesced satisfactorily, except for the fact that a vesicovaginal fistula soon developed. She was discharged from the hospital on the forty-fourth day after operation, her long stay being due to her cardiac condition. At the time of her discharge an x-ray of her heart was taken, and this showed marked dilatation of the right auricle. At this time the bladder held eight ounces of urine, and the vaginal leakage was slight. She was again admitted to the hospital on June 23, 1927, because of her heart condition and was again discharged eight days later. There was no change in the condition of the fistula. She has been examined every two weeks since that time and an attempt to close the fistula will be made later.



## CONCLUSIONS

1. Vaginal cesarean section is a useful operation when an indication for immediate delivery arises in a gravida with a long, rigid, undilated cervix, up to the end of the eighth month of gestation.

2. The operation may be done at term, as shown by one of the cases of this series; but here the difficulties are greater, and there is danger of the incisions tearing in the peritoneal cavity because of the large size of the child.

3. A previous low cervical cesarean section complicates the technic of the operation, since the anterior peritoneal culdesac has been obliterated. This may predispose to injury to the bladder during delivery.

4. Since the operation is extraperitoneal, postoperative complications are negligible.

5. The puerperium, as a whole, resembles that of any operative pelvic delivery.

6. The low transperitoneal abdominal cervical cesarean section which offers nearly as much protection against infection as does the vaginal hysterectomy has displaced the latter operation in a number of clinics because of its simpler technic.

270 COMMONWEALTH AVENUE.

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## IMMEDIATE REPAIR OF BIRTH CANAL INJURIES FOLLOWING DELIVERY

BY IRVING W. POTTER, M.D., F.A.C.S., BUFFALO, N. Y.

THE care of the woman who has given birth to a child, is so different today from what it was thirty years ago that it may be interesting to state the reasons for certain present-day procedures and the benefit that is supposed to be derived from their use.

Every effort possible is now made to obtain rapid and permanent involution of the uterus.

Subinvolution of the uterus is the cause of many of the ailments following childbirth. Conditions that invite subinvolution of the uterus are, therefore, the ones we are now trying to overcome and avoid, such as needlessly prolonged second stages of labor due to faulty positions of the child and not recognized; dystocia, maternal and fetal; prolonged pressure and stretching of the tissues of the birth canal, resulting in rectoceles and cystoceles; lacerations of the vagina, perineum, and lower uterine segment, all of which have a tendency to produce what we term subinvolution.

For the past few years we have heard, from various parts of the country, about the different methods used by many men to overcome these

tendencies, and we have carried on some experiments along these lines, which have proved beneficial to the patients.

Various exercises while the patient is in bed, beginning as early as the second day after delivery; changes in posture; the Fowler position for drainage, and later the knee-chest position to prevent retro-displacements and for the purpose of emptying the larger veins in the pelvis, thighs, and abdomen, thereby avoiding varicosities and perhaps lessening the tendency to thrombosis in these veins with their resultant bad effects and postpartum displacements of the uterus, which are often permanently corrected. Patients get out of bed feeling stronger, and have less of that dragged feeling with backache



Fig. 1.—Patient in position for examination after third stage of labor.

which was formerly so common. Constipation is less, and there is better control of the bladder.

The first step in my efforts to obtain good involution begins in properly preparing the patient for delivery. No patient should be delivered with a full bladder. The bladder should be emptied with a catheter before delivery, and if there is time, an enema may be given to cleanse the lower bowel.

I believe that the attendant is *not* responsible for lacerations of the lower uterine segment or cervix following delivery, unless he has needlessly interfered, or has dilated manually, or has applied forceps before complete effacement of the cervix has taken place, or has attempted version and extraction through an undilated cervix.

Many times I have examined carefully the lower uterine segment and the cervix and os following normal, untouched cases, which were delivered as vertex cases, and I have been surprised at the damage done as compared with those in which intelligent interference was

used; from these observations I believe that it is necessary, in order to obtain the best results, to prepare properly the birth canal for delivery.

The statement, previously made, that the attending physician is not always responsible for tears and injuries to the lower uterine segment of the uterus, does not apply so generally to the vaginal canal, as lacerations of the vagina and perineum can be prevented and should be greatly reduced in numbers and degree, when certain lines of pro-

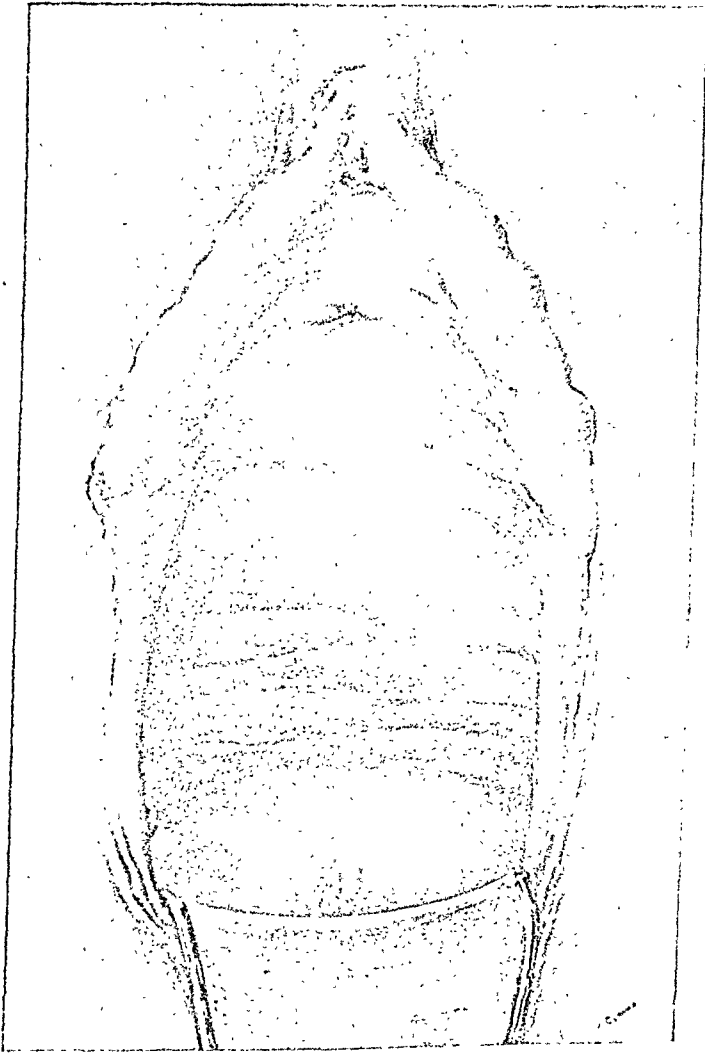


Fig. 2.—Birth canal exposed by speculum.

cedure are carried out. In order to accomplish these desirable ends, the patients, after the first stage of labor is finished or during the early part of the second stage, should be given chloroform to the surgical degree. No such term as obstetric anesthesia is used by me. A process of dilating or ironing out of the vaginal canal is begun by first introducing into the vagina one finger and beginning pressure from within out and from above down, then two fingers are inserted and then three fingers and finally the whole hand is introduced,

using green soap as a lubricant. Soap is not only used as a lubricant but is a cleanser for the canal. This preparation is carried out in every case, no matter what the position of the child is or what manner of delivery is to be used, as it reduces to a minimum the possible damage to the soft parts. By such a procedure my patients are not shocked, the elasticity of muscle is not destroyed, fascia is not so often broken, allowing rectoceles and cystoceles to occur; and episiotomies are unnecessary. The danger of hemorrhage need not be feared, pro-



Fig. 3.—Lower uterine segment brought down for inspection.

vided proper management of the third stage of labor is carried out, that is, in not hurrying in the delivery of the placenta and membranes. If the case be delivered as a vertex, time should be allowed for the passage of the head through the vaginal canal, and extension of the head should not be allowed to take place until the occiput is well under the symphysis. When the head is finally delivered as far as the ears, the operator should grasp the occiput firmly and rotate the head to one side or the other, according to the position of the child, and instead of the nose and chin passing over the thinned perineum, they

will be delivered sideways, and only the smooth side of the head will pass over the thinned perineum, thereby avoiding tears produced by the uneven surface of the face. After the head is delivered, it is allowed to assume its natural position of face down.

In the event of forceps delivery—I am speaking now only of mid forceps or low forceps, believing that high forceps operations, so-called, are things of the past—great care should be used in first making proper application of the forceps; then the head should be

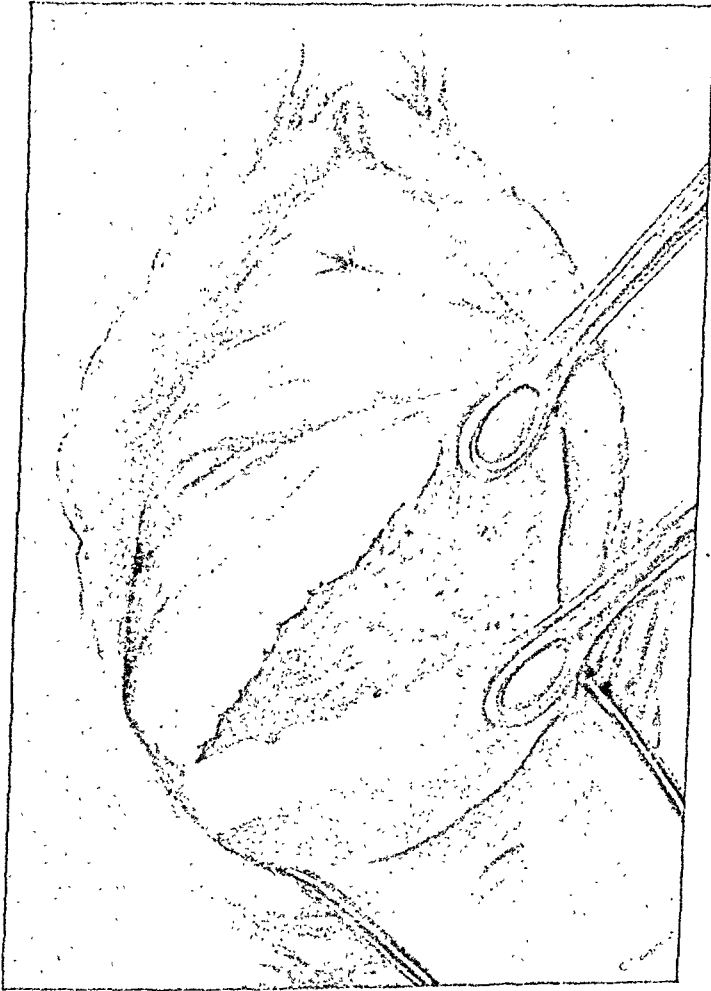


Fig. 4.—Beveling edges of cervix.

carefully brought down sufficiently for the instruments to be removed, when the head is delivered without them, exercising the same care to avoid lacerations as one would in a spontaneous vertex case.

In version and extraction, the same procedure must be used—first, to iron out thoroughly the vaginal canal until all resistance is overcome; it sometimes requires twenty or thirty minutes to accomplish this. I always wear long rubber gloves in my work, and I introduce the whole left hand into the vagina after it has been dilated, with the palm up, carrying the hand between the membranes and uterine

wall, if the membranes have not ruptured, well up toward the fundus of the uterus, separating the membranes around as far as the placenta, and avoiding, if possible, loosening the placenta, as that invites hemorrhage. The membranes are ruptured high up so as to save as much as possible of the amniotic fluid and the arms are now folded across the chest, if they are not already in that position, to avoid the complication of the extended arm, the feet are brought down and delivered, both at the same time between the first and middle fingers of the operator's left hand. From now on the extraction proceeds slowly and carefully to avoid damage to the soft parts of the mother and also to avoid injury to the child from too rapid extraction; the knees are now delivered and the buttocks rotate to the

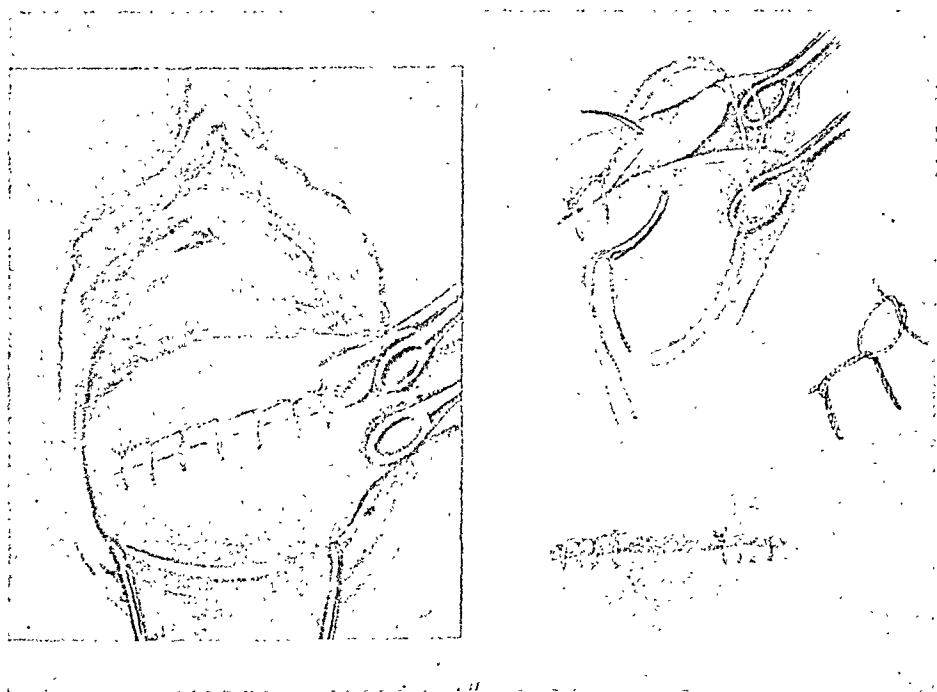


Fig. 5.—Showing insertion of sutures and external os.

hollow of the sacrum, where time is taken to allow the abdomen of the child to adapt itself to the pelvic outlet; then by gentle traction the back is rotated forward, squarely under the pubic arch, and traction is continued until the lower angle of the scapulae are seen, when the finger of the operator is put in the posterior axillary fold and the shoulder is rotated forward under the pubic arch. The child is then supported on the operator's hand and the posterior shoulder is rotated in the same manner and delivered as an anterior shoulder. Traction is not made downward toward the floor but in the direction of the patient's thighs, which are in a modified Walcher position.

The delivery of the after-coming head is now made as a flexed head by placing the fingers of the operator's left hand on the chin of the child and making pressure on the woman's abdomen above the sym-

physis with the right hand, thereby pushing rather than pulling the head through the pelvis. Great care should be taken to preserve the soft parts of the mother by not using too much haste in the delivery of the head. The child's body should still be in the direction of the mother's thighs and not bent back over the abdomen.

Breech cases, after complete effacement of the cervix, are delivered as footling cases, forceps being used upon the after-coming head if necessary.

For all of this work complete anesthesia is necessary, and damage to the vaginal canal and perineum will be reduced to a minimum.

After completion of the third stage of labor and while the patient is still under the anesthetic, careful inspection of the lower birth canal is made to see whether any repairs are necessary; this is accomplished by bringing down the anterior and posterior lips of the cervix with two cervix forceps. This is where I believe that great benefit can be done the patient by opening any cysts in the cervix or by removing them either by a broad sharp curette or with flat scissors, and also any diseased tissue that may be present. It is by this procedure that I cure the cases of old leucorrhea by beveling out the cervix and bringing the new-made raw edges together with two to three interrupted sutures of catgut or by a continuous suture starting at either angle and going toward the center, leaving space enough to admit easily the cervix forceps and thus not prevent subsequent drainage.

The lacerations of the cervix are unilateral, bilateral, and stellate. The unilateral tears are the most common and are found to some degree in practically every case and may be so slight as to require no attention; this is especially so in the primipara. The bilateral tears are found more frequently, following prolonged forceps and so-called dry labors. The stellate is the least common of all and depends largely upon the cervical tissue in which direction the laceration extends.

I have found that unilateral tears appear on the side of the cervix where the occiput has remained longest. For example, in prolonged L.O.P. positions it would appear on the left side, and in R.O.P. positions on the right side, being further proof of the damage resulting from these posterior positions.

In my work I do not often see bleeding from the tears of the cervix. Bleeding, if it occurs, usually comes from the placental site in the uterus and not from the cervix, proving that extensive and deep tears high up involving this circular artery are not common. Sutures are not always placed on account of visible lacerations, but many times in primipara they are put in the angle of the cervix to aid involution. In cases where previous lacerations existed, enough tissue is removed to bring the raw edges of the cervix together so as to cover all everted

surfaces. It is not always necessary to remove all of the scar tissue, as this is so stretched out and softened that future absorption of it takes place during the subsequent involution.

I am satisfied that the damage done the lower uterine segment is far less in cases that have been manually delivered than in many of those that are left to nature. The lower uterine segment, when brought down for inspection, is a sorry spectacle at best, resembling more the appearance of a ploughed field than anything I can describe, but it is far less rough in appearance in cases where intelligent interference has been made than in those cases left to nature.

In those cases not assisted, a dark congested area, resembling a band from  $\frac{1}{8}$  to  $\frac{1}{4}$  of an inch in width, is always noticed encircling the lower uterine segment and sometimes sufficiently devitalized so as to slough and cause future morbidity. This ring is never seen in the cases delivered manually.

I never have seen strictures of the cervical canal following this work. Drainage from the uterus is always ample and a postpartum examination from six to eight weeks after delivery shows no narrowing of the canal.

For the past three years I have used this method with very gratifying results in more than 1000 cases. I have found that it cures old previously existing cervicitis; it repairs old cervical lacerations, and it is a great aid in accomplishing and maintaining involution.

In primiparae, as a rule, no tissue is removed and sutures are merely placed to bring the torn edges together, thereby reducing future scar tissue to a minimum.

In old multiparae near the menopause, no attempt is made to save the cervix. I curette or cut down until I reach healthy tissue, and then bring the edges together in the manner heretofore described. This does away with all previous cervical erosions and cures, as near as anything will, the cervicitis which was due to the infection of the cervical glands, and can only be reached at this time and in this manner; this renders treatment with the cautery afterwards unnecessary. I never have seen any bad effects in subsequent labors. It does not delay the patient's stay in the hospital, in fact, if anything, it lessens the stay by bringing about a more perfect and speedy involution.

Patients return for final examination in six weeks, and many times it is difficult to say whether or not a full-term child had been delivered through that canal. At this time a sound can be introduced into the uterus to see that a proper canal exists, and if necessary, it can be dilated while the tissues are soft and yielding. Tears in the vaginal canal and perineum should always be repaired immediately. If such an unfortunate result as a complete tear into the bowel occurs, immediate repair should be attempted in the hope that possibly a good



result will be obtained. Failing in this, no further attempt at repair should be made until lactation ceases and menstruation appears, as then proper operative procedures can be better carried out.

This work which I have been engaged in for some years has also been done by Dr. J. L. Bubis, of Cleveland, and is reported in an article in *THE AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY*, August, 1925. He, however, extends the procedure and includes the repair of old cervical lacerations and the repair of cystoceles and rectoceles and has operated upon 152 cases very successfully. However, I am inclined to believe that there is some risk in this extensive work and not enough accomplished in securing involution; perhaps a better repair can be brought about later, but to neglect the repair of an old lacerated cervix with all of its associated pathology is wrong in the light of our present knowledge, because a proper involution of the uterus can never be brought about where there is an old diseased cervix. Furthermore, by this timely procedure we protect our patients from future malignant disease of the cervix, which in a certain percentage of cases begins at the site of a cervical injury, and we relieve them of the expense of a second operation, some pain and suffering, and some danger from a second anesthesia.

689 FOREST AVENUE.

(For discussion, see page 447.)

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## THE ETIOLOGY AND TREATMENT OF THE BLEEDING UTERUS

BY HENRY SCHMITZ, M.D., F.A.C.S., CHICAGO, ILL.

### INTRODUCTION

THE recognition of the disease causing or accompanying a uterine hemorrhage is of the greatest importance for the selection of the indicated method of treatment. A perusal of the medical literature on this subject depicts the differences prevailing in the interpretation of the underlying causes, the diagnosis, and the methods of treatment. For instance some of the advocates of either endocrinology, or surgery, or radiation therapy, leave the impression that all the varieties of uterine hemorrhages may be entirely combated by the sole use of one of the methods. The points at issue can only be cleared by a study of the causative factors and the functional and pathologic changes associated with uterine hemorrhages. Thereby a basis may be constructed whereon to build correct methods of prevention and of cure.

The investigations carried on by Fraenkel,<sup>1</sup> R. Meyer,<sup>2</sup> Novak,<sup>3</sup> and others on the internal secretion of the ovary and the influence of the graafian follicle and the yellow body on menstruation; the studies of

Hitschmann and Adler,<sup>4</sup> R. Schroeder,<sup>5</sup> and others on the cyclic changes in the histology of the endometrium, as well as the researches of Zondek and Aschheim,<sup>6</sup> Biedl,<sup>7</sup> Allen and Doisy,<sup>8</sup> and others on the influence of disturbances in the endocrine system on uterine and ovarian function and the composition of the maternal blood have greatly advanced our knowledge of the processes of ovulation and menstruation and their disturbances. The development of modern surgery, the introduction of x-rays and radium in therapy, and the standardization of endocrine extracts have all contributed to progress in the treatment of uterine hemorrhages. I shall endeavor to classify the causes of uterine hemorrhages according to the underlying pathologic physiology and histology and discuss the indicated methods of treatment for each group.

#### DEFINITION AND CLASSIFICATION

Uterine hemorrhages have been divided into (1) those dependent upon recent pregnancy, and (2) those independent of recent pregnancy.<sup>9</sup> It is now generally conceded that uterine hemorrhages occurring without the periods of gestation, pregnancy, and early puerperium are caused by either a disturbance in the uterus or the ovary, or internal diseases, especially of the endocrine system.

The gynecologic department in the medical school and hospitals, in which the material for study was obtained, is sharply separated from the obstetric department, and hemorrhages due to accidents of pregnancy, labor, and puerperium are rarely seen. They, however, constitute a large number of cases of genital bleeding. Therefore, it is imperative that the possibility of such disturbances must always be borne in mind to prevent mistakes of diagnosis and treatment. If a woman during the childbearing period of life complains of amenorrhea or a genital hemorrhage taking place after a period of amenorrhea or a missed menstrual flow, she should be deemed pregnant until proved not to be pregnant. If one is in doubt, a waiting attitude and observation will help in the diagnosis.

A small number of uterine hemorrhages are caused by general internal diseases as hypothyroidism, hyperthyroidism, pituitary gland disturbances, thrombopenic purpura hemorrhagica, and atypical purpura, acute infectious diseases as influenza, typhoid fever, scarlet fever, variola, rheumatic fever, malaria, etc., decompensated cardiac lesions, pulmonary emphysema, hepatic disease, chronic nephritis, etc. Such uterine hemorrhages are seen by us only in consultation with the attending internist. These hemorrhages if erroneously assigned to the gynecologic department are grouped in the accompanying tables in the columns on general stasis, systemic diseases or unclassified cases. Heyn<sup>10</sup> reported 285 cases of menorrhagia and found that 11.85 per cent resulted from passive congestion due to

general diseases. In 791 cases of uterine hemorrhages reported below the instance of general disease was 21 or 2.65 per cent.

A most careful interrogation of the patient is a *sine qua non* for the correct clinical interpretation of the uterine bleeding. The use of hemorrhage charts as devised by Kaltenbach<sup>11</sup> and R. Schroeder<sup>12</sup> is a great help to determine the type of bleeding, particularly to the medical student and the general practitioner, who see these cases usually before they enter a gynecologic clinic.

Menstrual hemorrhages are termed menorrhagias; intermenstrual hemorrhages are designated metrorrhagias. Menorrhagia implies that the menstrual flow is either too profuse, lasts too long, or occurs too soon in comparison to the behavior and type of the process of menstruation normal for a given case. The profuse and prolonged menstrual flow has also been termed hypermenorrhea; the too frequent menstruation, polymenorrhea. Both types may occur at the same time. The amount and duration of the menses depend upon the functional state of the uterus and active or passive pelvic hyperemia. The factors controlling the amount and duration of the menstrual flow are the contractility and tonicity of the uterine muscle, the degree of engorgement of the pelvic blood vessels, and the coagulability of the blood. Loss or decrease of contractility and tonicity is associated with hypoplasia, general and uterine asthenia, and myomas. Hyperemia may be either active or passive. Active hyperemia results from infections and displacements of the genitals, and passive hyperemia is caused by cardiac, pulmonic, hepatic, and nephritic diseases.

The periodicity of the menses depends upon the time duration of ovulation and the life duration of the expelled ovum. When the ovum succumbs, the menstrual decidua becomes detached, menstruation is started, resolution of the yellow body ensues and another graafian follicle develops. The duration of development of the graafian follicle is about fourteen to eighteen days, hence the potential life span of the expelled ovum is probably ten to fourteen days. If the time period of maturation of the follicle is shortened, or if the expelled ovum possesses a low vitality and is short-lived, then the menstrual flow will come on too soon. Disturbances of ovarian function may be primary or secondary. The primary dysfunctions are associated with the congenital hypoplastic state, which also involves the ovaries. Ovarian function suffices to bring about maturation of a follicle, but the produced ovum has a lessened viability or vitality. Such polymenorrhoeas occur with greatest frequency at the beginning of menstrual life when ovarian function is in the process of development to maturity, and at its termination when ovarian activity begins to ebb. The former are termed pubescent; the latter are designated menopausal hemorrhages.

Secondary ovarian hypofunction is caused by infections which invade the ovary or the corpus luteum, and endocrine disturbances and general diseases which interfere with the functions of the ovary.

Metrorrhagias are mainly caused by a chronic hyperplasia of the endometrium—the result of the persistence of a corpus luteum, malignant diseases involving the uterus, senile cervicitis and vaginitis, lues, etc.

## STATISTICS

A study of 2523 consecutive gynecologic cases, observed during 1924 and 1925, was made. At the Cook County Hospital 804 cases, and at the Mercy Clinic Hospital 1719 cases were seen. Of the latter 130 cases had to be subtracted due to insufficient data. The frequency of uterine hemorrhages was 42.70 per cent in the former and 28.07 per cent in the latter institution. (Table I.) This difference made it desirable to classify the hemorrhages separately for each hospital.

In Table II it is seen that inflammations of the uterus and tubes furnish the largest numbers of hypermenorrheas, namely, 51.04 per

TABLE I. GROUPING OF CASES ACCORDING TO TYPE OF BLEEDING

	COOK COUNTY	MERCY	TOTAL
Number of cases investigated	804	1589	2393
Number of bleeding uteri	344	447	791
Per cent of frequency	42.70	28.07	33.06
<i>A. Menorrhagia</i>			
Number	247	210	457
Per cent	72.04	46.98	57.78
<i>a. Hypermenorrhea</i>			
Number	223	163	386
Per cent	64.77	36.47	48.55
<i>b. Polymenorrhea</i>			
Number	24	47	71
Per cent	7.27	10.51	9.22
<i>B. Metorrhagia</i>			
Number	97	237	334
Per cent	27.96	53.02	42.23

TABLE II. GROUPING ACCORDING TO UNDERLYING DISEASES

Percentages Calculated for Each Type of Bleeding

*A, a: Hypermenorrhea 386 Cases*

	DECREASED CONTRACTILITY			HYPEREMIA	
	MYOMA	HYPOPLASIA	ASTHENIA	PELVIC INFECTIONS	GENERAL STASIS
Total number	131	17	38	197	3
Per cent	33.94	3.63	10.62	51.04	0.77

*A, b: Polymenorrhea 71 Cases*

	PRIMARY		SECONDARY	
	OVARIAN PUBESCENT	OVARIAN HYPOFUNCTION MENOPAUSAL	OVARIAN INFECTION	HYPOFUNCTION SYSTEMIC DISEASES
Total number	13	4	48	6
Per cent	18.31	5.63	67.71	8.45

*B. Metrorrhagia: 334 Cases*

	CHRONIC HYPERPLASTIC ENDOMETRITIS	MALIGNANCY	ACCIDENTS OF PREGNANCY	SENILE CERVICITIS	LUES	UNCLASSIFIED
Total number	42	202	52	5	13	20
Per cent	12.28	60.48	15.59	1.49	3.89	6.27

TABLE III. GROUPING ACCORDING TO UNDERLYING DISEASES  
Percentages Are Calculated From Total Number of Bleeding Uteri

<i>A. Menorrhagia</i>						
A. HYPERMENORRHEA						
	DECREASED CONTRACTILITY			HYPEREMIA		
	MYOMA	HYPOPLASIA	ASTHENIA	PELVIC INFECTIONS	GENERAL STASIS	
Mercy number	38	14	25	84	2	
Per cent	8.50	3.13	5.59	18.79	0.45	
County number	93	3	13	113	1	
Per cent	28.10	0.84	3.78	32.21	0.28	
B. POLYMENORRHEA						
	PRIMARY		SECONDARY			
	OVARIAN PUBESCENT	HYPOFUNCTION MENOPAUSAL	OVARIAN INFECTIONS	HYPOFUNCTION SYSTEMIC DISEASES		
Mercy number	11	4	27	5		
Per cent	2.46	0.89	6.04	1.12		
County number	2	0	21	1		
Per cent	0.45		6.11	0.28		
<i>B. Metrorrhagia</i>						
	CHRONIC HYPERPLASTIC ENDOMETRITIS	ACCIDENTS OF PREGNANCY	SENILE CERVICITIS	LUES	UNCLASSIFIED	
	MALIGNANCY					
Mercy number	30	148	32	5	8	14
Per cent	6.71	33.11	7.18	1.12	1.78	3.13
County number	12	54	20	0	5	6
Per cent	3.46	15.70	5.60		1.40	1.68

cent; inflammatory diseases of the ovaries the largest number of poly-menorrhoeas, namely, 67.61 per cent; and malignant diseases of the uterus the largest number of metrorrhagias, namely, 60.48 per cent. Among the colored women pelvic infections come first in frequency, namely, 32.21 per cent, and myomas come second in frequency as a cause for hypermenorrhoea, namely, 28.10 per cent. The percentages found in the other diseases give an idea of their relative importance. (Table III.)

The higher percentages of menorrhagia in the Cook County Hospital cases are due to the preponderance of myomas and pelvic infections. About 80 per cent of these patients are colored which explains these discrepancies. On the other hand the preponderance of the number of metrorrhagias in the Mercy Hospital, admitting only white people, is due to the greater frequency of malignancy.

#### TREATMENT

A patient suffering from uterine hemorrhages whether menorrhagia or metrorrhagia, should not be treated unless the underlying cause has been determined and a correct diagnosis has been made. All bleeding that does not occur synchronously with the physiologic menses must be viewed with grave suspicion until it has been proved to be benign. If a nodule in the vaginal portion of the cervix is incised and mucus exudes, it is probably benign; if arterial bleeding ensues, then a diagnostic excision must be made, for the nodule is probably malignant. If an ulcer on the vaginal portion of the cervix

is touched with a cotton applicator and does not bleed, it is probably benign; the cancer ulcer does bleed and the blood is arterial in character. If the introduction of a sound into the cervical canal and the uterine cavity, with strictest aseptic precautions, causes a thin stream of bright red blood to escape into the vagina, then this observation may be regarded as highly suspicious of malignancy, especially if the trickling of blood continues for some time after the manipulation. These signs are only a contributory means of arriving at a diagnosis and should not be conclusive. Carcinoma is a corrosive process; cancer tissue is friable, and these facts explain the observation. Every woman suffering from uterine hemorrhages should be examined and, if the cause does not become evident, the uterus should be curetted, suspicious looking nodules and ulcers of the cervix should be excised, and all the tissue should be examined microscopically. Such diagnostic curettage and excision of tissue should always be done immediately without any delay.

Postclimacteric bleeding without a lesion of the uterus is an important early sign of ovarian tumors. The tumors are often of the granulosa cell variety, and the uterine changes suggest ovarian hormonal influence. Such ovarian tumors are frequently carcinomatous. It would seem a mistake, therefore, to postpone operation until the appearance of a palpable tumor.

The principles of treatment of hypermenorrhea are: (1) the reactivation of the contractile power, (2) the tonicity of the uterine muscles, and (3) ablation of the active and passive hyperemia of the pelvis.

The polymenorrhea requires a correction of (1) the ovarian hypofunction, (2) the active ovarian hyperemia, and (3) any primary disease causing passive stasis.

The metrorrhagias indicate a removal of the underlying pathology.

Pelvic inflammatory diseases should be treated conservatively according to the well-established rules. If they do not react to conservative treatment, a temporary amenorrhea may be produced by the use of x-rays but not radium. A period of complete rest of the functions of the genital organs often contributes to a permanent cure.

Retrodisplacements and descent of the uterus should be corrected. The lacerated cervix should be repaired. The chronic cervicitis with erosions, hypertrophy, and nabothian cysts should be treated. If they resist treatment, the cervix should be amputated. The relaxed vaginal outlet should be restored by a perineorrhaphy, myorrhaphy, and anterior and posterior colporrhaphies.

The contractility of the uterus may be increased with hydrastis, extract of the posterior lobe of the pituitary gland, and adrenalin. Adrenalin solution 1:1000 may be injected intramuscularly in 0.75 c.c. doses twice weekly. Pituitary extract may be used in 0.015 gm. doses in solution intramuscularly twice weekly for twelve doses.

Hypoplastic uteri may be stimulated by the use of ovarian follicular hormone. Two hundred rat units should be injected intramuscularly twice weekly for about twelve doses. If results are not then obtained, the further administration is useless. Pratt and Allen<sup>13</sup> have reported clinical observations with injections of follicular hormone and state that they produce growth in the uterus.

Uterine asthenia is usually associated with general asthenia. As the body of the patient improves through regulation of diet, proper exercise, rest and sleep, and medication, so the tonicity of the uterus will increase.

Myomas, causing hypermenorrhea, may at first be treated conservatively. If a lasting improvement is not obtained, then surgery or radiation therapy are indicated. The contraindications to the use of radium and x-rays are so manifold that in thirty-eight bleeding myomas observed in this series at the Mercy Hospital, radium was indicated only seven times.

The polymenorrheas of puberty should be treated conservatively by general hygienic measures, hot vaginal douches, applications of heat with diathermy, the intramuscular injection at the beginning of the flow of 25 units of Collip's extract of the parathyroids, to be repeated within twelve hours. In the intermenstrual period 0.06 gm. doses of thyroid extract are given twice daily. If such measures do not bring results, then curettage is done, which is a stimulating measure as it promotes contractility of the uterus and thereby stimulates ovarian function. If the hemorrhages recur, curettage is repeated. The use of radium in pubescent women is deemed by us as absolutely contraindicated.

A more radical measure in both kinds of menorrhagia, due to functional disturbances within the uterus and ovaries, is curettage. Finally radium, x-rays or hysterectomy may be used, if all other measures have failed, and age does not contraindicate the use of rays. Curettage, fortunately, will arrest about 50 per cent of such bleedings. Radiation castration has supplanted corpus amputations for benign uterine hemorrhages in gynecologic practice.

The metrorrhagias do not require a detailed description of treatment. About 60 per cent are caused by cancers of the uterus, and about 12 per cent by chronic hyperplasia of the endometrium, also termed hemorrhagic myopathy or metropathy. About 15 per cent, in our series, resulted from a complication of pregnancy.

The chronic hypertrophy of the endometrium demands a more detailed discussion. The maturing follicle, for unknown reasons, may persist and continue to grow, forming a cyst the size of a walnut. The cystic follicle contains clear fluid. The walls are formed of a succulent, thick granulosa layer which rests upon a fibrous membrane and a theca interna, richly supplied with capillaries.

The uterus has a soft, loose, juicy, and bluish colored myometrium. The cervix is soft and wide. The endometrium is thickened. It represents a continuation of the premenstrual proliferative phase of the menstrual cycle. The surface may be smooth and even, or irregular, fuzzy, fungoid, or polypoid. On microscopic examination an increase of the epithelial and stromal elements is found. The glands are enlarged; many are cystic. The disparity in the glands is the most conspicuous feature. The epithelial cells are seen to be several layers thick. The stroma is markedly increased. Occasionally mitoses are noted. Necrotic degenerations of the hyperplastic mucosa are the real sources of the alarming hemorrhages seen in this disease.

About 70 per cent of endometrial hyperplasia due to a persistent ovarian follicle occur from forty-one to fifty years of age and about 25 per cent at the beginning of menstrual life, though it may occur at any age. Irregular and continued hemorrhages are the outspoken symptom. An amenorrhea of five to eight weeks, rarely longer, precedes the onset of the hemorrhage. On bimanual examination the uterus is large and soft in the climacteric metropathies, and the uterus may be hypoplastic but soft in the juvenile or pubescent metropathies; the ovary in both forms is cystic and about the size of a hen's egg.

The pubescent metropathy should be differentiated from a possible abortion and extrauterine pregnancy, the preclimacteric metropathy from a possible abortion and particularly malignant disease. Therefore, diagnostic curettage and microscopic examination of the scrapings are imperative.

The course is transient, especially if the graafian follicle ruptures or should be ruptured. Ovulation, follicle ripening, and corpus luteum formation may then again proceed normally. The endometrium undergoes resolution to normal.

The treatment of the juvenile or pubescent hemorrhages is difficult, as the cause lies in the function of the ovary and the organization of the ovum. There is a primary ovarian insufficiency plus an insufficient development of the uterus, especially of the myometrium.

The mode of living, labor and rest, diet, and exercise must be regulated. Adrenalin, parathyroid, and pituitary extracts should be given as mentioned before. Finally, the hemorrhage may be arrested by curettage, which may be repeated a second and third time. The persistent ovarian follicle may be ruptured bimanually under narcosis. In hemorrhagic diathesis x-rays may be applied to the spleen. The dose is 15 per cent of an erythema skin dose effective in the organ. If all treatment fails, the persistent corpus luteum should be resected.

The treatment of preclimacteric metropathies consists in a curettage which is curative in about 50 per cent of the cases. The scrapings must be examined histologically to exclude cancer. Recurrence of the



bleeding indicates the use of x-rays or radium. Radiation therapy has supplanted quite a number of abdominal and vaginal corpus amputations in benign uterine hemorrhages.

#### SUMMARY

1. A classification of uterine hemorrhages based on the etiologic factors has been given.

2. The types of uterine hemorrhages have been grouped into (a) menorrhagias, and (b) metrorrhagias. The menorrhagias have been subdivided into hypermenorrhoeas, if the menses are too profuse or last too long, and polymenorrhoeas, if the menses occur too soon.

3. The treatment of the conditions causing hypermenorrhoea, polymenorrhoea, and metrorrhagia has been given.

4. Hemorrhagic metropathy has been discussed. It is divided into the juvenile or pubescent and the climateric or menopausal hemorrhagic metropathies. The etiology, pathology, symptomatology, and therapy have been given. Hemorrhagic metropathy, or endometrial hyperplasia due to a persistent ovarian follicle, is the most important form of the metrorrhagias, if malignant diseases are excluded.

5. It is imperative that curettage be performed and the scrapings examined microscopically, if the cause of the bleeding cannot be determined. Otherwise hidden malignant disease may be overlooked.

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(For discussion, see page 438.)

## THE EARLY DIAGNOSIS OF CANCER

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THE question of early diagnosis of cancer is a serious one. It is strange that a disease which has been recognized for centuries, which was well known to the ancients and has been dreaded at all times, should be so insidious in its onset that we still are entirely ignorant as to its exact cause.

True it is that we do speak of certain lesions or conditions as pre-cancerous because our experience and observation have taught us that cancer very often follows in their wake, or develops upon them. However, it does not always do so, and we do not know why it occurs in the one instance and not in the other.

Some people question whether the disease is more common now than formerly, but on the whole, competent observers and statisticians seem agreed that it occurs more frequently and is definitely on the increase.

In a disease so prevalent that we know one in every ten adults now living will die from it, and among women between the ages of forty-five and sixty-five, one in every five deaths is caused by it, we would reasonably expect that a large fund of information concerning all phases of the disease would be available, and that the earliest stages would be readily recognizable and a matter of common medical knowledge.

Let us now ask ourselves: can we make beyond a reasonable doubt a diagnosis of incipient or early cancer, based upon its gross characteristics?

In answer to such a question I imagine that each of us immediately constructs a mental picture of a lesion arising in some organ or part of the body with which we have had considerable experience.

If we recall the earliest lesions we have observed, no doubt the picture will be either a wart or a superficial ulcer with surrounding induration, or a nodule or lump of variable size.

On further thought, however, we shall probably realize that in the vast majority of instances our earliest diagnoses were accidental, were not based upon definite symptomatology, occurred in the course of treatment for a supposedly benign lesion, and were based upon routine microscopic study of tissue removed during such treatment. Moreover, in some instances the malignant nature of the lesion had not even been suspected by us and the report from the pathologist came as a great surprise.

The speed with which symptoms occur and attract the attention of the patient depends largely upon the sensitiveness of the organ in-

volved and upon the ease with which its function can be disturbed by a small lesion. For instance, a minute lesion on a vocal cord or on the tongue may attract attention promptly, whereas a neoplasm of the liver or bowel, uterus, or ovary may attain considerable size before recognizable symptoms occur.

It is evident that early clinical diagnosis of cancer in the various organs of the body is entirely dependent upon three factors: the location of the organ, the ease with which its normal functions are disturbed, and the nature of the symptoms produced by the lesion.

It is utterly hopeless based upon these three factors to hope to make an early diagnosis of internal cancer except by accident.

What are the readily recognizable factors that are common to the different varieties of the disease?

In the first place, the primary lesion is always identifiable as an overgrowth of cells that heretofore have been normal and essential to the integrity of the organ in which the disease has located. These cells, however, no longer behave as normal cells; they have acquired a tendency to rapid division and growth, and still more important, to invasion and destruction of adjoining normal tissues and replacement by the cancer cells. Even more interesting is the fact that the individual cancer cells, if broken off from the original tumor but still remaining in their host, may be carried by the lymph or blood streams to other places. These cells retain the power to grow and reproduce themselves and eventually may form a tumor which in many of its gross characteristics will resemble the original tissue from which the cell was derived.

When we, therefore, take the factors which are common to cancer in any part of the body and which may aid us in reaching an early and correct diagnosis, we have first, evidence of preceding persistent benign disease, or chronic irritation which has usually been present over a considerable period of time, the so-called precancerous lesion.

Second, we find increased size or bulk of the organ, or part involved, or a definite lump.

Third, the consistency of the tissues involved is more dense and resistant, and less elastic than normal.

Fourth, there is a definite impression, especially in the more superficial cancers, as seen on the lip, tongue, or vulva, of a piling up of cells or exudate in and under the skin or mucous membrane, forming a small localized tumor which at first does not seem to have much invasive tendency but rather soon, in fact while it is still quite small, tends to ulcerate on its exposed surface, and thereafter gradually but definitely increases in size and bulk and soon shows glandular metastasis. When an internal organ gives symptoms of sufficient degree, verified if possible by x-ray studies, to lead to surgical intervention, the disease will nearly always be found to have gone beyond

the early stage. The operation usually reveals a definite tumor, often with attachment to neighboring structures or with glandular involvement.

It is useless to talk of early diagnosis in cancer of the stomach, for instance, for it may exist without sign or symptom and be recognized only by roentgen-ray studies. On the other hand, cancer of the skin, lip, tongue, breast, vulva, penis, should be discovered promptly by the patient, and the diagnosis should be made without unnecessary delay by the physician.

Cancer of the breast presents probably the most difficult problem in this group. A single nodule with evidence of fixation should be investigated; freely movable or multiple nodules are more likely to be benign or to indicate chronic mastitis.

Carcinoma of the cervix cannot be expected to give early symptoms; there is no function to be interfered with, a watery discharge or leucorrhea is not typical and when bleeding occurs, it is in most instances due either to ulceration of the cancer tissue which is no longer able to maintain its integrity or to rupture of blood vessels from infiltration with cancer. In any case bleeding is an indication that cancer cells are in direct contact with the blood stream and with the lymphatics, and the probability of metastasis or extension from the primary site is assured.

The gross appearance of early carcinoma of the cervix is in no sense typical. In fact it is exceedingly difficult to distinguish chronic cystic and interstitial cervicitis with erosion from moderately developed or early infiltrating epidermoid carcinoma with ulceration. Erosions, in my experience, are seen in younger women, as a result of irritating discharges following abortions or full term pregnancies, or from venereal infection. Since these causative factors of erosion are less common in women over forty years of age, likewise erosions are infrequent, and when found at this time of life, they should be regarded with grave suspicion, for many of them are actually instances of incipient cancer.

The benign lesions of the cervix found in women over forty years of age are nearly always characterized by increased connective-tissue production and cyst formation and not by erosion or ulceration. Moreover, mucus predominates or forms a large part of the discharge from a benign cervical lesion and is rarely present in cancer of the cervix.

The vast majority of the cases of carcinoma of the cervix are histologically of the squamous cell or epidermoid type. A very small percentage, about 2 per cent to 3 per cent, arise from the cells of the cervical glands and are of the adenocarcinoma type.

Let us now consider the gross anatomic lesion or lesions as observed in carcinoma of the cervix. In practically every instance the cervix is larger, more bulky, nodular, and more irregular in outline than nor-

mal. There is usually a distinct asymmetry as regards the location of the external os. This increased size is due to tumor growth and invasion of the normal structures of the cervix by the neoplasm, and to some extent to increased tissue production and lymphocytic reaction as a defensive or protective measure.

Our experience leads us to believe that carcinoma of the cervix seldom begins as a superficial ulcer and only rarely ulcerates early in the disease. The exceptions are the cases of papillary, fungating, cauliflower carcinoma, which form huge, friable, spongy masses of newgrowth on the surface of the cervix and for a long time show only slight tendency to invade the normal tissues. There are also a very small number of slow-growing, prickle-cell, squamous, epidermoid carcinomas, which invade slowly, ulcerate early, remain comparatively superficial for a long time, closely resemble a chancre, and are very resistant to ray therapy.

Early diagnosis of cancer, I believe, in the light of our present knowledge, is largely a speculative matter, and yet its early recognition is important, for, if curable at all, it is only in its initial state.

According to Maud Slye "two factors are necessary to produce cancer, one, an inherited susceptibility to the disease, and the other, irritation of the right kind and in the right degree applied to the cancer-susceptible tissues."

In the case of a suspicious nodule in the breast we shall do well to remember Bloodgood's statement that "the warnings of cancer are not different from those of the local lesions which are not cancer" and that early benign but precancerous breast tumors "can be differentiated only at the exploratory operation, and that the final decision rests upon the microscopic study."

Most of us feel that cancer seldom if ever begins as cancer but is preceded always by certain well-recognized precancerous conditions in various portions of the body, such as syphilis of the tongue, leukoplakia of the vulva, chronic endocervicitis and laceration of the cervix, chronic mastitis, warts, birthmarks, moles, burns, scars, etc., which if present or known to have been present at the site now occupied by the neoplasm, increase the probability of its being cancer.

As a final conclusion, however, we can say that biopsy with microscopic examination of the tissue by a competent pathologist is essential in the early stage of growth of the lesion for exact diagnosis of cancer. It is, of course, possible that serologic tests may eventually open the door to early diagnosis without biopsy but at present there is none that is reliable. As W. Sampson Handley has well said, "The detection of early cancer is not a one-man job. It may require the cooperation of the patient, the family doctor, the specialist, and the pathologist. It may be impossible even then, in some cases."

✓ **PREMATURE SEPARATION OF THE NORMALLY IMPLANTED  
PLACENTA WITH SPECIAL REFERENCE TO  
THE KIDNEY IN THESE CASES**

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**PURPOSE.**—It is not the purpose of this paper to reconsider the question of premature separation of the normally implanted placenta from the standpoints of multiple etiology, pathology, symptomatology, classification for obstetric treatment, obstetric treatment itself and results or bibliography. Williams,<sup>21, 22</sup> Holmes,<sup>12, 13</sup> Polak,<sup>17</sup> Willson,<sup>23</sup> Portes,<sup>18</sup> Phaneuf,<sup>19</sup> and others have well covered these aspects of the condition. Goethals, of the Boston Lying-In staff, working independently has just now done the same with the series from which the bulk of our material is taken.

Our purpose at the start of this study was to link up the group of these cases in which the kidney is involved with our previous work on the "toxemic-chronic nephritic" group. We sought to clear up in our own minds certain questions regarding the kidney which presented themselves to us as we debated treatment in a given case. We felt that though much had been accomplished along lines of obstetric treatment by our predecessors, much room was left for a better understanding of the treatment in relation to the kidney. We felt that if we could obtain this understanding by study, we could lower our mortality rate. We were particularly impressed by the group of patients with separated placentas—clinically distinct from anuric eclamptic, patients who showed marked anuria. We were totally at a loss to explain the urine and blood chemistry findings observed over a period of days in some of these cases by the pathology implied by the terms chronic nephritis and acute nephritis. We hoped that a study of our material would throw some light on these and other puzzling questions.

**Literature.**—From the voluminous literature on "separated placenta" we wish to consider only those contributions which bear on the subject under discussion.

The association between nephritis and premature separation of the placenta, according to Essen-Möller,<sup>7, 8</sup> was first pointed out by Chantrenil in 1881. Winter,<sup>25</sup> in 1885, presented three cases and noted the occasional presence of nephritis with the condition. Secondly, he advocated endometritis as an etiologic factor. His observations were corroborated by Hennig,<sup>10</sup> Weiss,<sup>24</sup> Lehman,<sup>14</sup> and Hofmeier.<sup>11</sup> Holmes,<sup>12</sup> in 1901, was not impressed by the presence of albuminuria in these cases. He stated that "kidney changes" were noted only 20 times in 200 cases, and he believed that endometritis was the principal factor.

In 1903 Muus<sup>15</sup> and in 1905 Paul Bar<sup>2, 3</sup> suggested that the same intoxication which caused eclampsia was also the cause of accidental hemorrhage. Bar and Kervily<sup>3</sup> later reported the death of a patient from premature separation of the placenta. Liver changes similar to those in eclampsia were found. These are the first observations in the literature relating to premature separation of the placenta, toxemia of pregnancy, and eclampsia.

It remained, however, for Essen-Möller, in 1913, to emphasize the important connection between toxemia of pregnancy, eclampsia, and premature separation of the placenta. He says, "And last of all it is striking how often the general state of the patient in a case of accidental bleeding resembles an intense intoxication, as we see it in eclampsia. But the other reasons I have mentioned speak very much in favor of the supposition that accidental hemorrhage and eclampsia are genetically connected. The increased blood pressure, which is so common in eclampsia, may also be of some importance for the separation of the placenta. The albuminuria would thus only be a symptom of the general intoxication which in one case causes eclampsia, in another case accidental hemorrhage, in a third perhaps both these diseases. But this does not of course give any explanation as to the origin of the accidental hemorrhage. The problem will then form a part of the great problem of eclampsia or of the toxemia of pregnancy. But the fact that the two groups of symptoms which we formerly took to be indicative of two different diseases, can be looked upon from a common point of view, seems to be an advantage."

Williams believes that from observations of the relation of premature separation to eclampsia, there must be some connection between it and the toxic process. However, he is unwilling to concede that the concomitant toxemia is of the pre-eclamptic variety but "is of a special type concerning whose causation we are at present ignorant."

DeLee<sup>5</sup> mentions the frequent association of toxemia of pregnancy and nephritis and the premature separation condition. Ahlström,<sup>1</sup> Shaw,<sup>20</sup> and Portes in particular, believe toxemia of pregnancy is the underlying factor in all except the occasional unexplained case.

Particular reference to renal involvement or renal disease in the literature is not made except in the earlier writings already described or in an occasional general statement. Williams<sup>21</sup> noted albuminuria in 11 out of 29 cases, Gaston,<sup>9</sup> 30 out of 70; Bar and Kervily, 38 out of 58; Dorman,<sup>6</sup> 82 out of 158, and Essen-Möller, 11 out of 29 cases. However, later authors note a much higher incidence of albuminuria in their collected reports. Willson (1922), in reviewing 69 cases, notes that albuminuria was present in 86.2 per cent of cases in which the urine was noted. He was able to find only 9 instances in which the blood pressure readings were recorded. The average systolic pressure was 182 mg. Hg. Clinical or pathologic evidence of toxemia was found in 87.7 per cent of 57 cases. Eight and six-tenths per cent of the patients showed eclamptic convulsions. Strikingly similar are the findings of Portes in 1923. In a report of 73 cases he found clinical evidences of toxemia of pregnancy in 91.3 per cent, albuminuria in 88.5 per cent, and eclamptic convulsions in 8.3 per cent.

Mention of complications which may follow premature separation of the placenta is restricted to the description of postpartum hemorrhage. We have been unable to find suggestions by any author that complete or partial suppression of urine associated with premature separation of the placenta, either with or without eclampsia, is an important or dangerous complication. In a number of reported cases in which the urinary output is described, there is, however, a definite urinary suppression. Couvelaire<sup>4</sup> in a report of two cases (1912) mentions a para v, thirty-one years old, who was transported to the operating room in extremis. A Porro-caesarean section was performed. This patient had a partial suppression, certainly during the first two days postoperative, and died on the third day. His second

case, a primipara, eclamptic, with premature separation of the placenta delivered normally, and had thirty-four hours with absolute anuria for two days postpartum. A bilateral decapsulation of the kidneys was performed, but the patient died thirty-four hours after delivery. On autopsy, edema of the perirenal tissue was found. The kidneys showed only congestive changes consistent with capillary dilatation. The convoluted tubules were occupied with cellular detritus and fine granular cylinders.

Oldfield and Hann<sup>16</sup> report a more typical case. Their patient was a primipara, thirty-eight years old, with signs and symptoms of premature separation of the placenta. At the time of operation only 1.5 ounces of blood-stained urine was obtained, "loaded with albumin." Complete urinary suppression followed for thirty-six hours and partial suppression for three or four days, after which the urinary output increased, and the patient made an uneventful convalescence and was albumin-free on the seventeenth day. These authors are the first and only ones, as far as we have found, to note that urea excretion was diminished and to describe the urinary sediment.

*Material.*—The original material on which this study is based consists of approximately 165 cases indexed as "separated placenta." All but 13 of these occurred in the last ten years of the Boston Lying-In Service. The others were seen by me (F. S. K.) in my private practice and are included because most of the patients have been under observation three years or more, a point of great importance. These 165 cases briefed and studied were immediately reduced in number to 60. The other patients had definitely separated, low-attached placentas, or were definitely traumatic, or gave insufficient recorded data to make them of any value to us. The remaining 60 cases were all associated with what we have called the "toxemic-chronic nephritic group." Intensive study of these 60 cases led us to omit 31 more. The reason for this reduction was that though they belonged in the group, we saw that the data were insufficient to advance our ideas. Of the remaining 29 cases, each, for one reason or another, seemed to us to possess more merit for study than the usual reported case.

*The Groups.*—It is impossible in a paper of this length to enter into the detail of these 29 cases. If we indicate why we venture to state that they possessed more than average merit for study; if we detail the single case which first brought to a head our interest in this subject; if we then offer our opinions based on this work, and draw such conclusions as we may, we shall have accomplished all that our time permits. Nor are we disposed at present to publish the cases as they stand in protocol, for the reason that in the next few years opportunity for interval study in most of the surviving cases will have occurred. We therefore offer our effort to you in a tentative and preliminary form.

Our best method of indicating briefly why we think these cases are more valuable than average seems to be to group them under certain headings. We studied them in this way because each group contained the suggestion of a possible answer to one or more of our questions.



Please bear in mind that we are not yet concerned with statistics and figures, that some of the cases fell into more than one group, and that, therefore, the addition of the group figures which we present will not and should not equal the 29 patients from whom the material came.

*Group 1.*—Five cases not accompanied by eclampsia in which complete anuria was present in 2, and marked incomplete anuria in the other 3. Of these patients 3 died and 2 recovered.

*Group 2.*—Five cases associated with eclampsia. We would emphasize one feature common to these 5; namely, that each had had her convulsion prior to placental separation.

*Group 3.*—Eleven cases in which satisfactory and reasonably complete blood chemistry, blood pressure, and urinary data were recorded.

*Group 4.*—Eight cases. Each patient had been in hospital for treatment of toxemia of pregnancy with elevated blood pressure, albumin in urine, and other symptoms, and had cleared so completely that she was either just home, or on the eve of discharge, when separation occurred.

*Group 5.*—Twelve cases in which we have partial adequate interval study, or a definite history of marked toxemia in more than one pregnancy.

Besides studying these groups, we think we have made three other observations in this condition. We know or suspect these have been previously made, and we insert them here simply as confirming the observations of others. (1) These patients have high white counts (in so far as our limited data go) and, since high white counts may result from throwing foreign protein into the blood stream, we have a certain amount of added theoretical evidence that this group of separated placentas is caused by a protein toxic agent. (2) Certain of these patients show increased bleeding and coagulation time. (3) As these patients entered the hospital, inspection, as a rule, classified them into one of two types. The first of these is the nephritic type; generally characterized, we think, by relatively moderate parity when seen. The second type, older in years, stringy, worn, many para, looking like the more usual hospital patient with placenta previa. We think that it is in this type that endometritis may be the main etiologic factor; whereas, in the other group we feel convinced that the same etiologic factor as in toxemia plays the major rôle in the premature separation.

Having as briefly as possible outlined the cases in groups, we shall cite in detail the history of a patient who increased our interest in the pathology and treatment of toxic premature separation. She led us to an intensive study of the literature and to a feeling that we could not be content with it. Especially were we impressed by the slight amount of available information, to say nothing of the marked disagreement of authorities, concerning kidney pathology in these cases. We sought further information from the genitourinary surgeon, from the internist, and lastly by good chance from a well-known

student of the physiology of the kidney, and we found only a little suggestion of help from them. It must be said that what actually took place in the kidneys of the patient about to be described is not yet known. Autopsies as we have seen them, and those cited by Willson, do not help. They are few in number and by no means meet the requirements of the clinical picture. We suspect, as with our own, that the ones he reports were done on patients dying relatively soon after delivery. The single autopsy finding, Couvelaire's second case in which at autopsy, "edema of the perirenal tissue was found, the kidneys showed only congestive changes consistent with capillary dilatation; the convoluted tubules were occupied with cellular detritus and fine granular cylinders," corresponds to the clinical picture in those anuric patients who recover.

## THE CASE

M. B., para i, forty years old, had scarlet fever when four years old; also tonsillitis when a child. She first came to the prenatal clinic Jan. 21, 1927. Last period was Sept. 1, 1926. Expected date of confinement June 8, 1927. On Oct. 1, 1926 there was slight antepartum bleeding.

On this first prenatal visit, the patient had a systolic pressure of 160. No albumin. According to our system she was referred to the hospital for study. Hemoglobin, 30 per cent; red count, 3,516,000. Blood chemistry was within normal limits (see Table II). Eyegrounds negative. Pthalin 35 per cent. One hour renal test was normal.

TABLE I

HOURS	OUTPUT	INTAKE	B. P.
1st 24	4 drops	Subject. Sal.	1500 c.c. Low
		25% glu. intra.	300 c.c. 100/70
		Subject. Sal.	1600 c.c. High
		Transfusion	500 c.c. 120/80
			3900 c.c.
		By mouth and rectum up to	6360 c.c.
2nd 24	45 c.c.	Subject. Sal.	1500 c.c. Low
		25% glu. intra.	250 c.c. 125/65
			1750 c.c. High
		By mouth and rectum up to	6270 c.c. 170/80
		Sal.	3000 c.c.
		Glu. intra.	250 c.c.
3rd 24	135 c.c.	By mouth and rectum up to	3860 c.c. Low 150/85 High 200/120
4th 24	267 c.c.	All by mouth	2610 c.c. Low 155/85 High 200/120
5th 24	217 c.c.	Subject sal.	1500 c.c. Low
		By mouth and rectum up to	3460 c.c. 160/85 High 180/95
Total 634 c.c.		Total	22560 c.c.

During eight days in the hospital her blood pressure dropped to 120/80. She was discharged to the toxemic clinic. She reported there four days later, and from February 11 to March 8 her blood pressure ran from 154 high to 136 low, and no albumin.

At 3:00 P.M. on March 27, 1927, she vomited and lost one ounce of fluid blood from the vagina. She felt giddy and faint, had blurred vision, but no loss of consciousness, headache, or abdominal pain; fetal movement ceased. On entrance to hospital blood pressure was 160/100, pulse 120, temperature 98.2°; uterus was board-like and tender; fetal parts could not be mapped out, and fetal heart could not be heard; there was slight red vaginal staining. No rectal or vaginal examinations were made. Reflexes were active; she had moderate edema of extremities, and slight edema of face and retina. Urine at this time was 4 c.c. in amount, cloudy red, with trace of albumin, occasional red blood cells, hyaline, and granular casts.

To recapitulate: February 7, 1927, a patient is discharged from hospital with normal blood pressure and urine, negative blood chemistry, and negative kidney tests. She is followed as carefully as possible in the special toxemia clinic. Fifty days later she appears, an undoubted case of toxic separation, in excellent condition for section, and with a good prognosis in comparison to that of a similar patient bled out. Cesarean section, confirmation of the diagnosis by the appearance of the uterus, separated placenta, dead baby, and free blood and clots. Uterus acted well and is left in, little postpartum bleeding; pulse, and pulse pressure satisfactory.

By this time we have learned that hemorrhage is not the only thing that may kill a patient with separated placenta, even in the noneclamptic group, and that speedy surgery applied early and ample transfusion do not always save such patients. Accordingly, the patient is catheterized every eight hours, has four-hour blood pressure readings, and these observations are checked up against our treatment. Table I shows results by twenty-four hour periods.

From the fifth day on, the output steadily rose to a maximum of 112 ounces on the ninth day when that side of the matter was considered closed. During these nine days the albumin dropped to the slightest possible trace, then cleared up except occasional S. P. T., apparently from pus in the urine. The urine became pale, and casts and cells disappeared in five days. The blood pressure dropped to 160, and ultimately to 120.

The use of the 25 per cent glucose intravenously three times in the effort to open the kidney was checked up by blood-sugar tests, done as part of the routine blood examinations. These findings are accordingly shown. (Table II.)

The patient, after a stormy convalescence with low grade sepsis in wound and uterus, was ultimately discharged obstetrically well to the Boston State Hospital for the Insane, where she had previous admissions.

These tables taken from the case detailed above, and more or less like the other anuric cases we have studied, illustrate several points.

TABLE II

DATE	N. P. N.	BLOOD UREA NITROGEN	BLOOD URIC ACID	BLOOD SUGAR	BLOOD CHLO- RIDE (CHECKED HIGH, LOW)
2/ 2/27	26	8.5	31	74	
Day of 1st ad.					
3/28/27	59	31.9	6.7	143	554
Day after del.					543
3/29/27	64	38	7.3	111	566
					566
3/30/27	86	50	8.8	143	554
					554
3/31/27	67	32.7	10.7	117	531
					531
4/ 1/27	100	66.1	11.4	166	508
					496
4/ 2/27	110	66	10	122	507
					496
4/ 3/27	120	70	10	126	508
					531
4/ 8/27	60	41	8	100	554
					543
4/15/27	33	16.9	4	52	519
					508
6/ 1/27	18	7.2	2.7	81	514
					508
6/11/27	27	9.3	2.9	100	496
					496

Mg. per  
100 c.c.  
Whole Blood

These are (1) the progressive slow recovery of the kidney when it begins to secrete; (2) the tremendous intake of fluids we use in the effort to force the kidney to secrete; (3) at first the progressively increasing blood pressure and later its high stabilization between high point and low point, accompanied by the progressive urinary output; (4) the use of concentrated glucose intravenously to produce hyperglycemia, in an effort to obtain diuresis. This is checked by the daily blood-sugar findings as illustrated in Table II by the figure 166, which represents the culmination of three days of intravenous glucose therapeutically. At this figure or somewhat below, sugar appears in the urine. (5) It illustrates that the kidney must recover its ability to secrete nonnitrogenous material including water, first because it shows the maximum of nitrogen-retention on the seventh day of the puerperium while at this time large amounts of urine of high specific gravity are already being excreted. This is as one would expect from the long time necessary to produce uremic death and uremic blood findings experimentally. One patient in our anuric series died on the sixth day with uremic blood findings and in typical uremic coma with uremic twitchings, though she was not an eclamptic on entrance.

Furthermore, Table II illustrates a patient who comes to us with a history, of an age, with appearance, with blood pressure—all suggestive of chronic nephritis, but whose blood chemistry, eyegrounds, and reaction to treatment demonstrate that she is not a chronic nephritic

in the accepted sense of the term. She then passes through an almost complete kidney shut-down and during this time shows urinary findings and blood-chemistry findings approaching those of a woman about to die of uremia. Yet two months later she emerges with the same normal blood chemistry, urine, and blood pressure that she had in the beginning. If we attempt to place the rôle of chronic nephritis in these cases, we are in no position to do so accurately with our present knowledge. The appearance of albumin in the urine, elevated blood pressure, etc., in more than one pregnancy does not permit of this diagnosis on the one hand, and on the other, retained nitrogen products in the blood does not mean simply chronic nephritis, but means a decompensated nephritis, since upwards of two-thirds of the kidney tissue must be out of commission before sufficient nitrogenous products are piled up to be demonstrable in the blood. We have in this series data of four cases which lead us to believe that they are at present, and presumably were chronic nephritic patients at the time of separation, but we are not yet sure. We have a feeling that not a few will turn out to be chronic nephritic patients, but this feeling is based more on the inspection of the patient than on anything we are yet able to demonstrate. When we make this statement, we are sensible of the observations made in other toxemic clinics, particularly in Baltimore and in New York, as well as in our own, on the development or at least on the discovery of chronic nephritis subsequent to various forms of toxemia of pregnancy. As yet, these are not convincing to us in anything like the proportion of cases so described. We feel that only by many years of observations of many of these patients, or better by the development of some more delicate test of kidney insufficiency than has yet been offered, can the true rôle of chronic nephritis be known in separated placentas.

#### CONCLUSIONS

1. We believe that the major result of this study has been to show us more tangibly than before how we should approach and follow each case of so-called toxic separated placenta.

2. We believe that anuria in separated placenta is a complication to be feared and to be combated as we have outlined, from the first moment that the patient is seen, with forced fluids by mouth and rectum and under skin, glucose 25 per cent in vein, and usually transfusion, fluids up to from 6000 to 7000 c.c., checked up by daily blood chemistry, by blood pressure and by eight-hour interval catheterizations with urine analysis.

3. We believe in this connection that the preservation of a relatively high blood pressure is an important part of the treatment and that it represents a protective mechanism against the anuria.

4. We believe that in the eclamptic group of separated placentas, dropping pressure to control convulsions should be exercised with great caution lest the patient be aided to become anuric.

5. We believe that on the chances the etiologic factor in toxemia of pregnancy and toxic separation of the placenta is sometimes, at least, the same. We base this belief on the fact that we have been able to collect 8 cases of definite toxemia without convulsions (nephritic as far as we can say at present) that separated just as the signs and symptoms of toxemia had abated.

6. We believe from this group that extreme supervision should be exercised after a toxemic patient has improved to the point of discharge, and that she should be warned to remain quiet and report if she has the slightest bleeding or abdominal pain.

7. We believe that the explanation of what actually takes place in the kidney in these cases, whatever its pathologic background, must be sought in further study of the physiologic exchange in the kidneys, rather than along lines of autopsy pathology.

8. We believe that decapsulation of the kidney has no place in these cases.

9. We believe that every effort should be made by every obstetrician and clinic to link up these cases with the "toxemia-chronic nephritic" group, and study them with careful tests and gather all available data, over the longest possible period. This so that as the scientific laboratory comes forward with more light on the etiology or etiologies of these conditions, the clinical laboratory will not be behind in case groupings to fit.

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(For discussion, see page 451.)

# THE PROGNOSIS IN ACUTE AND CHRONIC NEPHRITIS OF PREGNANCY FROM THE STANDPOINT OF CLASSIFICATION

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THE physician is frequently consulted concerning prognosis in cases of pregnancy or on the advisability of future pregnancy if a woman has symptoms of nephritis or has had nephritis or toxemia in a previous pregnancy. The opinion prevails that a woman with a history of nephritis should be advised against future pregnancies, and yet careful observation of such a case may reveal that the function of the kidney is more than sufficient to carry the patient through pregnancy under careful supervision. Conversely, if renal injury is serious, the physician should advise against future pregnancy, until a careful rechecking of conditions shows that renal function is adequate. The modern conception of nephritis is that it is a local manifestation of a diffuse disease affecting the entire vascular system. The disease varies in degree and extent, depending on the potency of the toxin attacking the vascular system and on the organ or organs most severely affected. Study of the nail-fold capillaries in eclampsia reveals changes similar to those in acute nephritis, such as areas of contraction and dilatation of the capillary loops. Changes in the retinal vessels are further demonstration of the widespread vascular character of the disease.

The vascular involvement may be generalized and without apparent renal injury. The vessels may return to normal after confinement, or so-called benign hypertension may follow, or the injury may be the beginning of progressive arteriosclerosis finally terminating in malignant hypertension. In such widespread vascular injury, the kidneys often bear the brunt of the attack and the capillary tufts of the glomeruli can be so seriously injured that complete recovery is not possible and renal function is chronically impaired. Similar injury to the liver may pass unnoticed because of the wide margin of safety which must be overcome before symptoms of hepatic insufficiency are manifest, and because of the liver's strong power of regeneration.

Clinical evidence indicates that the kidneys are affected in most cases of preeclamptic or eclamptic toxemia. Volhard emphasizes the resemblance between true eclampsia and the convulsive form of uremia. One of us (Mussey) has noted the close similarity of preeclamptic toxemia and eclampsia on the one hand and acute glomerulonephritis on the other.

In a study of 100 cases of renal injury resulting from pregnancy, Rockwood, Keith, and Mussey found that the nephropathy of pregnancy could be grouped according to Volhard and Fahr's classification of nephritis as follows:

- A. Pyelitis and pyelonephritis
- B. Hypertension and nephritis
  - 1. Acute nephritis
    - a. Acute glomerulonephritis
    - b. Acute nephrosis
  - 2. Chronic nephritis
    - a. Chronic diffuse glomerulonephritis
    - b. Chronic nephrosis
  - 3. Sclerosis (vascular lesion)
    - a. Benign hypertension
    - b. Malignant hypertension

The pyelitis and pyelonephritis complicating pregnancy are relatively common; they will not be discussed here.

#### HYPERTENSION AND NEPHRITIS

Important findings in acute glomerulonephritis are hypertension, edema, and albuminuria usually with erythrocytes in the urine and lowered urine output. Although this disease is described as inflammation confined chiefly to the glomeruli, it is usually associated with more or less evidence of tubular injury. Nephrosis is described as a degenerative lesion of the tubules. Its chief features are marked edema with lowered urine output, albuminuria, usually casts, but few, if any, erythrocytes and no hypertension. In acute nephritis of pregnancy, these two lesions are frequently associated so that Fahr and Baer define them by the term glomerulonephrosis.

The diagnosis of acute nephritis and acute nephrosis in pregnancy rests chiefly on clinical data. Rarely is there phenolsulphonaphthalein retention, or increase in the nonprotein nitrogen in the blood. While laboratory examinations, aside from tests for albuminuria, are not of great value in the acute nephropathy of pregnancy, they are often of distinct value in the differential diagnosis and prognosis of chronic nephropathy. Several types of chronic nephritis may develop as a sequence of renal injury which has not resolved following confinement. It is evident that the degree of interference with renal function varies with the type of lesion and the extent of involvement. We found that in most cases classified as acute nephritis the patients recovered completely, although in some cases the disease progressed to the chronic stage. In cases diagnosed focal nephritis, nephrosis, or benign hypertension, the prognosis was favorable, while in those classified chronic glomerulonephritis, malignant hypertension, and chronic (diffuse) nephritis, the prognosis was poor.



This study demonstrated that the classification of nephropathy resulting from pregnancy is of value in prognosis. By applying this classification in cases of pregnant women with symptoms of nephritis and of women in the childbearing age with nephritis, in combination with tests of renal function, we have been able to determine the prognosis in certain cases more accurately.

These women are given a careful general physical examination, and previous illnesses, particularly those complicated by nephritis, are noted. If there is evidence of edema or hypertension, if albuminuria is present, or if there is a history of previous renal trouble, further tests are made. Increase of urea or nonprotein nitrogen in the blood, or the prolonged retention of phenolsulphonephthalein is evidence of lowered renal function. If function is seriously curtailed, the specific gravity of the urine is relatively fixed. While in normal persons on a dry diet, the urine will be concentrated and the specific gravity should rise to 1.025 or more, conversely, following the drinking of a quantity of water in a short space of time, the specific gravity of the urine should be distinctly lowered.

Conclusions may be drawn more accurately if the doubtful case is examined in hospital. The patient is kept in bed on a prescribed diet and fluid intake for several days during which time blood-pressure readings are recorded and the ocular fundi examined. The output of urine is measured, the phenolsulphonephthalein test is made, and the nonprotein nitrogen in the blood is determined. Two days are set aside for determining the upper and lower limits of the specific gravity of the urine. For the concentration test, the patient is given food for a day consisting of 20 per cent solids only; no fluids are given. The urine is collected at three-hour intervals. The specific gravity should reach 1.025. In the water test, 1500 c.c. (seven and a half glasses) of water is given on an empty stomach between 8:00 and 8:30 A.M. The urine is collected every half hour for the next four hours. The normal output varies between 1200 and 1800 c.c. and the specific gravity should be as low as 1.003.

#### ILLUSTRATIVE CASES

CASE 1: NEPHROSIS.—A woman, aged twenty-seven, was pregnant for the second time. There had been no untoward symptoms during the first pregnancy. She was under observation during the last five months of the second pregnancy; slight edema appeared in the ninth month and the urine contained albumin, graded 4, but there was no hypertension. The hemoglobin was 60 per cent.

After confinement the edema and albumin disappeared. Since then a third pregnancy has been normal.

CASE 2: NEPHROSIS.—The patient,\* a primipara, aged twenty-one, was first seen in labor. There was edema, graded 3, and albuminuria, graded 4, but the urine contained no casts nor red blood cells; the blood urea was normal and there was

\*Case 3 in: Rockwood, Reed, Mussey, R. D., and Keith, N. M.: Surg., Gynec. and Obst., 1926, xlii, 342-350.

no elevation of blood pressure. The patient was delivered of a healthy child. Since that time the patient has been delivered three times without recurrence of the renal symptoms.

**CASE 3: ACUTE GLOMERULONEPHRITIS.**—A woman, a primipara, aged twenty-five, had slight edema and albuminuria at fifth month, which disappeared under treatment but reappeared ten days before she came under our care at the thirty-fifth week of gestation. The systolic blood pressure was 168, the diastolic 100. There was edema, graded 3, and the urine contained albumin and casts. The ocular fundi were normal. In the next six days, in spite of active treatment, all symptoms increased in severity. Five days later, the systolic blood pressure was 182 and the diastolic 108. Lobulated detached areas appeared in both retinas. Following confinement, the blood pressure dropped, the edema of the retina disappeared, the retinas became reattached and vision became normal.

A second pregnancy was not attended by any recurrence of the toxemia or ocular symptoms, and the blood pressure, renal function, and the blood urea were normal. A few old pigment changes were visible in the ocular fundi.

**CASE 4: ACUTE GLOMERULONEPHRITIS.**—The patient, a primipara, aged twenty-one, was examined in the thirty-fourth week of pregnancy. She had been troubled by headache and blurred vision, and progressive edema had developed in the last ten days. The systolic blood pressure was 176, the diastolic 96. There was edema, graded 3, and the urine contained albumin and casts, graded 2. The ocular fundi showed contraction of the arteries, moderate edema, and detachment of the retina. Labor was induced, and the uterus was emptied the following day. Two days later the ocular condition was much more acute, as there was generalized edema with large lobulated detached areas. Following this, improvement was rapid.

Subsequent examinations have shown normal blood pressure, no albuminuria and normal renal function. The eyes have returned to normal. If this patient is kept under close observation, pregnancy should be carried through successfully.

**CASE 5: CHRONIC FOCAL NEPHRITIS (?)**—A woman, aged twenty, with a child aged five months came to the clinic September 6, 1922. As a child she had had scarlet fever without complications. In 1917 and 1918 she was ill and Bright's disease was diagnosed. She was well until anuria appeared two days prior to labor in April, 1922. No anesthetic was given on account of the renal condition. There were no convulsions.

At examination, the patient complained of tiring easily. The patient weighed 114; there was no edema, and only a small amount of albumin in the urine; the systolic blood pressure was 105, the diastolic 56; the blood urea was 23 mg.; the phenolsulphonephthalein test gave a return of 55 per cent; the eye grounds were normal; the tonsils were infected.

A tentative diagnosis of chronic focal nephritis was made. Tonsillectomy was performed. Two years later the patient reported that she had no trouble during a subsequent pregnancy, and since then cholecystectomy and an operation for laceration had been performed.

**CASE 6: RECURRING (?) TOXEMIA OF PREGNANCY.**—The patient, a primipara, aged thirty, came to the clinic January 23, 1923. She had had one miscarriage at eight weeks, a year and a half before. She was six months pregnant and had vomited for the first three months. The systolic blood pressure was 206, the diastolic 144; the pulse was 104; there were edema, graded 3, retinal changes of a nephritic type, and albuminuria, graded 4; the phenolsulphonephthalein return was 35 per cent; later it was 65 per cent; blood urea was 22 mg. She was delivered of a macerated fetus four days after her arrival at the clinic.

When she was dismissed, February 24, the systolic blood pressure was 150, the diastolic 95, the urine contained albumin, the phenolsulphonephthalein return was

55 per cent, blood urea was 18 mg., and there was no edema. By water test, the specific gravity of the urine was 1.002; by concentration test, it was 1.028. In 1926 the urine contained no albumin, and her blood pressure was normal. It was believed that this was a case of cured acute glomerulonephritis. However, in April, 1926, the patient wrote that when six months pregnant she caught cold, albumin appeared in the urine, and she was delivered of a dead fetus. Following this the albuminuria disappeared. This may be a case of the recurrent toxemia of pregnancy described by Kellogg.

**CASE 7: SEVERE ACUTE GLOMERULONEPHRITIS WITH HEALING.**—The patient, a primipara, aged thirty, consulted us July 29, 1924. The systolic blood pressure was 188, the diastolic 144; there was edema, graded 3, albuminuria, graded 3, and the blood urea was 71 mg. Six days later there was spontaneous delivery of a seven-months' living fetus. Under treatment the patient improved steadily and has regained her normal strength.

July 6, 1925, the systolic blood pressure varied between 134 and 118, and the diastolic between 90 and 70; the phenolsulphonephthalein return was 60 per cent and the blood urea was 17 mg. There was at times a trace of albumin in the urine. By water test, specific gravity was 1.002 with an output of 1345 c.c.; by concentration test, 1.030. Healed glomerulonephritis was diagnosed. The patient was advised to avoid pregnancy for one or two years and to have the renal function reinvestigated.

**CASE 8: MILD CHRONIC NEPHRITIS.**—A woman, aged thirty-three, who was pregnant for the fourth time, had been advised to have a three months' pregnancy interrupted on account of nephritis. She consulted us January 26, 1925. Six and a half years previously there had been miscarriage of a dead fetus at five months following "flu." Two and a half years later labor was induced at seven months on account of hypertension with nephritis. The child is living and in good health. A year later there was spontaneous birth of a six months' dead fetus. The patient had had excellent antenatal care, there was no albumin in the urine, and she felt well until twelve hours before labor when there was a sudden disturbance of vision which lasted for two weeks. The systolic blood pressure had ranged between 150 and 158 since the second pregnancy, but the patient felt well.

At examination, the systolic blood pressure was 164 and the diastolic 120; the urine contained albumin, graded 2, but no casts; there were few hypertensive changes in the retinal arteries. After ten days in the hospital, the systolic blood pressure was 138 and the diastolic 90; there was no albumin in the urine, the phenolsulphonephthalein return was 70 per cent; the blood urea was 14 mg., and the hemoglobin was 85 per cent. By water test, the specific gravity of the urine was 1.002; by concentration test, 1.028.

The patient was advised to continue the pregnancy. Under careful observation and on a strict diet, she was spontaneously delivered of a living child at the eighth month, following spontaneous rupture of the membranes. There had been no more albuminuria, and the systolic blood pressure did not exceed 150 after the period in hospital at the third month.

**CASE 9: MILD CHRONIC NEPHRITIS.**—The patient came to the Mayo Clinic in May, 1926, seven months pregnant. There had been two previous stillbirths, one in 1915, at term, when craniotomy was performed; another in 1924, when a macerated seven-and-a-half-months' fetus was delivered. During the second pregnancy she was under our observation at the fourth and seventh months. At the fourth month the systolic blood pressure was 150 and the diastolic 90; there was a trace of albumin in the urine, and no edema. The patient did not follow instructions, and when she returned at the seventh month, the systolic blood

pressure was 186 and diastolic 124; there was albuminuria, graded 3, edema, graded 2, and the blood urea was 18 mg. The patient again failed to follow instructions and two weeks later had premature labor and delivered a dead fetus.

At examination, May, 1926, the systolic blood pressure was 140 and the diastolic 80; there was no albumin in the urine. This time the patient followed instructions and was delivered at the eighth month of a living child. Two months later the systolic blood pressure was 137 and diastolic 80; the urine contained albumin, graded 1; the phenolsulphonephthalein return was 55 per cent, and the blood urea was 17 mg. We believe that in this case low-grade chronic nephritis is present, but that renal function is adequate to withstand pregnancy under carefully controlled conditions.

**CASE 10: CHRONIC NEPHRITIS WITH HYPERTENSION.**—The patient, aged thirty-three, mother of three children, consulted us January 19, 1925. The last pregnancy had been terminated at seven months (October, 1924) on account of marked albuminuria, casts, a systolic blood pressure of 230, and impending eclampsia. At this time, the systolic blood pressure was 200 and the diastolic 122; the hemoglobin was 68 per cent; the urine contained albumin, graded 4, casts, graded 1, and red blood cells, graded 2, and had a specific gravity of 1.021; the phenolsulphonephthalein return was 60 per cent, and the blood urea was 22 mg. The ocular fundi showed mild retinal arteriosclerosis of the hypertensive type. The patient was in the hospital for eight days, after which the systolic blood pressure was 158 and the diastolic 128; there was a trace of albumin and an occasional pus cell in the urine. By water test, the specific gravity of the urine was 1.004, and the output 1565 c.c. No concentration test was made.

Pregnancy was advised against until further observations could be made. April, 1926, the systolic blood pressure was 180; there was no albumin in the urine, and the patient was able to do most of her work.

In this case subacute glomerulonephritis had probably developed into mild chronic nephritis with hypertension.

**CASE 11: SUBACUTE DIFFUSE NEPHRITIS.**—A woman, aged thirty-five, who had been twice pregnant, consulted us January 17, 1925. In May, 1924, when she was six months pregnant, albuminuria had appeared; later there had been hypertension and edema, but no headache or eye trouble. Labor occurred at eight months; it was prolonged and a stillborn babe was delivered.

Eight months later the patient returned for examination to determine whether it was safe for her to become pregnant.

The systolic blood pressure was 220, the diastolic 130; there was albuminuria, graded 2, and the phenolsulphonephthalein return was 50 per cent. The eye grounds showed considerable retinal arteriosclerosis. After the patient had been in the hospital for nine days, the systolic blood pressure was reduced to 168, the diastolic to 110; the urine contained only a trace of albumin and a few red blood cells. By water test, the specific gravity of the urine was 1.003 and the output 1200 c.c.; by concentration test, the specific gravity was 1.025.

Subacute diffuse nephritis of pregnancy was diagnosed. The patient was advised against further pregnancy until defective teeth had been removed and until she could be reexamined at the end of a year. We learned that she became pregnant shortly after returning home. In August, 1925, she wrote that she was "fighting albumin in the urine" and expected confinement in November. The outcome in this case is not known. The symptoms of nephritis had probably recurred during pregnancy because the patient had not waited until they had abated sufficiently.

**CASE 12: HYPERTENSION AND CHRONIC NEPHRITIS.**—A woman, aged thirty-eight, who had been pregnant once, consulted us May 11, 1925. Three years before, labor was induced at seven months on account of rising blood pressure (the systolic was 210 at the time of delivery) without edema, headache, or blurred vision. There was pyuria at the time and albuminuria since. The systolic blood pressure varied between 145 and 164.

At examination, the systolic blood pressure was 190, the diastolic 112, the urine contained albumin, graded 2, and pus, graded 1; the hemoglobin was 64 per cent, the phenolsulphonephthalein return was 40 per cent, and blood urea was 26 mg. Examination of the ocular fundi showed mild hypertensive sclerosis. The patient spent ten days in hospital on a diet. The systolic blood pressure was reduced to 138, the diastolic to 98; there was a trace of albumin in the urine, the hemoglobin was 72 per cent, the phenolsulphonephthalein return was 60 per cent, and the blood urea was 24 mg. By water test, the specific gravity of the urine was 1.002 and the output 1175 c.c.; by concentration test the specific gravity was 1.021.

Hypertension with mild chronic nephritis was diagnosed. Further pregnancy was advised against. January 5, 1926, the patient was in excellent health and had no unusual symptoms of any kind.

**CASE 13: CHRONIC GLOMERULONEPHRITIS.**—A woman, aged eighteen, once pregnant, came to the clinic April 15, 1923. She had had scarlet fever in 1919. There had been a miscarriage at seven months following a convulsion in July, 1922.

When she consulted us, there was a possibility that she was pregnant, although examination of the vagina showed apparently complete atresia. The systolic blood pressure was 176 and the diastolic 112. The average specific gravity of the urine was 1.009; it contained albumin, graded 3, and occasional red blood cells; there was edema, graded 3; there was no return of phenolsulphonephthalein in the test of renal function; blood urea was 158 mg. and hemoglobin was 33 per cent. There were marked retinal changes characteristic of nephritis.

A diagnosis was made of extensive chronic glomerulonephritis in an advanced stage. The patient died June 20, 1923.

**CASE 14: HYPERTENSION, ARTERIOSCLEROSIS, AND CHRONIC NEPHRITIS.**—A woman, aged thirty-six, consulted us August 15, 1923. Ten years before she had had premature labor at seven and a half months and a dead baby was delivered. She had had dim vision for ten days. There had been two spontaneous miscarriages, one at six months, and one at four months, following a "stroke" during which she almost died. On examination, three months later, the systolic blood pressure was 204 and the diastolic 120; there were residual right hemiplegia and aphasia. September, 1926, the systolic blood pressure was 216 and the diastolic 130, the phenolsulphonephthalein return 55 per cent, the blood urea 28 mg., the eye grounds showed sclerosis of the retinal arteries, and there was no albumin in the urine which had a specific gravity varying from 1.008 to 1.014. At this time she was three months pregnant.

Hypertension, probably of the malignant type, with arteriosclerosis and mild chronic nephritis was diagnosed; therapeutic abortion was advised.

#### SUMMARY

The classification of nephritis of pregnancy as acute and chronic and the study of renal function in the individual case is an aid to prognosis.

Patients with acute nephritis rarely give a history of previous renal trouble. The presence of albuminuria, the rather sudden rise in blood pressure, and increased edema usually occur during the eighth

or ninth month. Tests of renal function show adequate excretion, aside from oliguria, the specific gravity of the urine is high, and the ocular fundi may reveal evidence of acute changes in the vessels and retina.

Patients with chronic nephritis often give a history of previous nephritis. Albuminuria, hypertension, and edema are apparent earlier in pregnancy, usually before the seventh month. Tests of renal function often disclose retention of nitrogen and phenolsulphone-phthalein. The specific gravity of the urine is fixed or low, and there is definite secondary anemia. Examination of the ocular fundi often reveals changes resulting from previous nephritis.

Most pregnant women with acute nephritis recover with little or no demonstrable impairment of renal function. In some cases the disease will progress to the chronic stage. Many pregnant women with a history of nephritis but with no gross impairment of renal function can be carried safely through pregnancy under careful supervision. Chronic nephritis with seriously lowered renal function distinctly increases the hazard to mother and child.

*(For discussion, see page 448.)*

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## THE SIGNIFICANCE OF RETRODISPLACEMENTS OF THE UTERUS AND THE PRINCIPLES INVOLVED IN A SATISFACTORY CORRECTION

BY DAVID HADDEN, M.D., OAKLAND, CALIF.

PROBABLY I am venturing, when one with more wisdom would hesitate, in bringing before you for discussion a subject that, since the days of the birth of gynecology, has developed more difference of opinion than any other in the field of female pathology. In view of the attention given to retrodisplacements of the uterus and the voluminous literature produced, it would seem that by this time we should have reached a clear-cut vision of the etiology and treatment of this condition, and yet I venture to say that in the discussion to follow, we shall have almost as many views expressed, at least as to treatment, as there are speakers.

For the sake of confining discussion to the subject of the paper, I wish to state definitely that I am not considering procidentia. While a posterior rotation of the uterus, either partial or complete, always precedes a uterine prolapse due to the direction of the pelvic planes, yet the causative factors underlying the two conditions are not wholly the same so that a prolapse may develop in a pelvis where the uterus has previously been in normal position until the time the procidentia appeared. I feel justified in considering this subject in view of the essays that have appeared somewhat recently, wherein the authors ridiculed the condition as being of any moment pathologically and cast

discredit upon those who attempt surgical treatment. One writer speaks of replacing the displaced organ "by gently folding its arms behind its back." Another, as an argument against congestion being produced by the posterior rotation, asks "whoever saw a retrodisplaced uterus ever change its color upon replacement." That such articles have developed the opinion among some internists and others that retrodisplacement of the uterus is of no significance pathologically and that correction is unnecessary and even unjustifiable, I am fully persuaded.

That any one pathologic condition can bring forth over 120 types of operation for its correction, I believe shows that we have not yet fully mastered the principles involved or that we are laying too much stress on little modifications that cut no great figure and are thereby causing the average surgeon to lose sight of those principles. Certainly the medical student with such a mass of operative detail to consider must become bewildered and often fail to grasp the fundamentals.

The men who devised and those who have conscientiously employed one or more of these 120 types of operative correction certainly cannot be credited with doing such work for the sake of fees. Again when benefit to the patient results, we certainly cannot in all cases credit the psychic effect alone with the improvement. Retrodisplacements of the uterus would be a thing unknown if women walked on hands and feet, as would any pathology of importance resulting from childbearing injuries.

Nature certainly intended the uterus to lie horizontally in the pelvis, to be free to move within a certain arc so as to compensate for the distended bladder and rectum, and to be able to grow unhampered in pregnancy. Any condition of retrodisplacement or any fixation of the uterus is an abnormal state. That that state should produce abnormalities of function seems to me to be undeniable. It is perfectly reasonable to expect to find a certain group of women in whom the uterus is small because of underdevelopment, and whose sensibilities perhaps are less acute than the average, who go through life with no consciousness of the abnormality; such are the cases hardly requiring surgical treatment. On the other hand, every honest gynecologist sees many corrected cases cured of their pelvic distress, with the nervous system regenerated in which no other pathology existed. Fortunately we have available a simple method of determining whether such an uncomplicated retroversion is producing symptoms, but unfortunately this method seems to be falling rapidly into disuse. My experience has been that the younger medical man is not taught or, if taught, does not understand the principles and application of the retroversion pessary. If they attempt the use of the pessary, they often overlook the fact that a replacement is the first essential, or they use

a stock form unmindful that many cases require alterations in the curves to fit the individual. I am sorry to say that the majority of the women who have been fitted with pessaries, who drift into my hands, show an improper adjustment with naturally an unsatisfactory outcome.

That the position of the uterus is dependent upon any one factor alone is untenable. There are various factors maintaining the normal position, and each has its own part to play. The structures at the cervical pole support and immobilize that pole. The lateral ligaments prevent rotation and side drift and the fundus supports maintain flexion and allow for elevation but restrain overexcursion. The proper functioning of these various ligaments is dependent to a very vital degree upon the existence of a closed pelvic cavity as maintained by an intact pelvic outlet.

The intact perineum keeps the abdominal and pelvic cavities closed. Thus, under balanced forces and in the resulting closed chamber, the uterus practically floats with even pressure on all sides, except what may be exerted by the variation in cavity contents and respiration. Given, however, an injured outlet, permitting the entrance of air within the vagina, the uterine balance is disturbed, and the cervical structures are forced to bear the strain of support. That a marked relaxation of the perineum with its gradually increasing pull of growing rectocele and cystocele will in time stretch these cervical supports and allow a lowered cervix and an elevated uterus is rationally conceivable, though most retrodisplacements following labor, are hastened by injuries to the structures at the cervical level. A lowered cervix and an elevated fundus must result in a retrodisplacement because of the direction of the pelvic axis and the force lines of the pressure from above. Conversely, it is poor surgery to do any operation for the uterine displacement correction and neglect a relaxed outlet.

With a retroversion, whether secondary to a labor with a resulting relaxed outlet or one that is not so associated, the circulation is interfered with through twisting of the uterine and ovarian arteries and veins, so that the body becomes congested and soft and with the softening a flexion develops.

Once retroverted, the uterus has no tendency to return to the normal for all the pressure from above is on the caudal surface, and the pressure of the bowel contents makes a valve of the fundus. The ligaments are all suspensory and obliged to carry weight for which they were not intended. The tubes are rotated and the ovaries prolapsed, and the condition is aggravated more and more with each developing degree of retrodisplacement. The increased congestion in a body incapable of free expansion, as is the ovary, is bound to produce a tendency to pathologic changes with resultant symptoms.



It is, I think, not unreasonable to believe that the rotations in the fallopian tube may account for some cases of sterility associated with retrodisplacements. Here I wish to sound a warning against tubal inflation in any case of uterine retrodisplacement, without first replacing the uterus. You know what a worn soft garden hose does when the water pressure is turned on and the hose gets kinked. It would not take much pressure to injure the mucous membrane of such a flexed fallopian tube to a sufficient degree to produce inflammation enough to injure that tube permanently. I sound this warning because I have seen some of our obstetricians doing just this thing.

With perhaps the exception of those cases of infantile uterus that are retrodisplaced, a simple case of retroversion does not long remain an uncomplicated one. Even though the ovaries and tubes may not become early prolapsed, there is an interference with their venous circulation due to stretching of the infundibulopelvic ligaments and the twisting of the broad ligaments, so that a hypostatic congestion is produced which tends to develop cystic ovaries. The gradual increase of ovarian weight encourages prolapse. The cervical portion of the uterus is also congested because of twisting of the uterine vessels, and thus there is a tendency to endocervicitis with its end-results of cystic degeneration.

Whether the symptoms so often relieved by a retrodisplacement operation are due to the more normal circulation established in the uterus alone or in the ovaries and tubes alone or in both, is problematic. That only partial relief of symptoms credited to corrected retrodisplacements is obtained can readily be explained by the doing of many types of operation in which the tubal and ovarian elevation is not accomplished. We all know that a prolapsed ovary as an entity has its train of pathology and symptoms and yet many of the advocated displacement operations still leave the appendages low in the pelvis.

In considering the correction of retrodisplacements, I believe it would be well to divide our cases into two classes, separating thus the women who have borne no children from those who have. Such a division would simplify our viewpoint and favor more rational discussion.

The woman with the relaxed outlet and the strained cervical supports, whether the retrodisplacement was primary or secondary to her labors, presents a much more complicated problem. There is a greater lateral elongation of the broad ligaments with more flaccid sacrouterine and vesicouterine structures, although we usually find more body to the round ligaments. The attenuated round ligament is more frequent in the nullipara. In the nullipara unless complicated by some gross pathology, such as tubal or other inflammatory conditions which

have thickened up or stretched out the broad ligaments, the operative correction presents few difficulties, and the maintenance of the forward position requires little tension exerted upon the supporting structures, for there is no downward drag tending to disturb the uterus, and the abdominal pressure helps maintain the posture. Any simple reefing of the round ligaments is sufficient, provided the appendage pull is corrected. Such shortening can be as readily done outside the abdominal cavity if there is no ovarian prolapse and no other pathology exists which requires abdominal entrance, which I acknowledge is not often if the abnormal position is of long duration.

In the woman with a relaxed outlet the primary requirement is, I feel, the proper closure of the pelvic outlet, with the uterine correction secondary. I regret the fact that the tendency of the average operator is to do the abdominal operation and neglect the plastic. If for any reason only one step must be taken and no acute abdominal condition exists, it should be the floor and diaphragm repair. No matter what type of operative uterine correction is done, it will be endangered sooner or later by a relaxed outlet.

In all surgical procedures for the correction of a retrodisplaced uterus, we must recognize first the necessity for an intact, or the production of an intact, pelvic diaphragm and floor. We must not interfere with the free excursion of the uterus within its normal range of motion; this demands that the uterus must not become adherent to the bladder or to the abdominal wall. We must not permit a heavy ovary or ovaries to act as a backward drag upon the fundus; this may even produce a recurrence of the uterine displacement. We must not depend alone upon the round ligaments, no matter how strong, to sustain the uterine position; the broad ligaments have broadened during the period of abnormal position, and the uterine and ovarian vessels have become tortuous.

With these requirements to fulfil, it is evident that the type of operation that fixes the uterus to the peritoneum or abdominal wall is defective through limiting the uterine excursion and producing an abnormal direction for the uterine axis. The type of operation using the round ligament drawn through the abdominal wall is unsatisfactory, because that ligament was never intended for a suspensory ligament and will elongate, also the direction of support is abnormal and the ovarian and tubal drag is still present. In neither type is the broad ligament slack corrected. The plication of the round ligaments and thus, the broad ligaments in front of the uterine body, is a little more rational but has the great disadvantage of a possible bladder fusion, nor does it correct the ovarian prolapse, and it may even distort the arterial and venous uterine and ovarian supply and aggravate uterine stasis.

The type of operation that seeks to reef the round ligaments along their normal course and within the broad ligaments and peritoneal folds presents perhaps less objections as to stasis and abnormal attachments and certainly produces the necessary flexion of the uterus and narrows the broad ligaments, but it does not correct the ovarian prolapse and must be accompanied by an uterine ovarian ligament shortening.

Any operation that confines itself to the plication of the sacro-uterine ligaments alone seems to me hardly worthy of considerations; theoretically, it is a most rational way to elevate the cervix and produce a forward position of the body, but practically the structure of the ligaments does not favor proper fusion and the overloaded lower bowel tends to stretch the shortened tissues.

Finally, the type referred to in my quoting of the satirical reference "to gently folding its arms behind its back" can be an operation which fulfills all the conditions or it may be only a partial success. If the peritoneum is stripped back as the round ligament is drawn through, the broad ligaments are not shortened. If the loop of round ligament is placed too high on the body, too near the fundus, the body can slip under. If the loops are placed too low, the fundus can and will flex over the attachment. Properly done, the operation will correct all the pathology but does produce an abnormal relationship laterally, because of the distorted position of the distal portion of the round ligaments, which depresses the outer portion of the broad ligament, and probably for this reason Webster advised the use of a pessary for some months.

Since 1907 I have been using, when indicated, the Webster operation with my own modifications. First, I do not strip the round ligament from the broad ligament but simply pull the round ligament through the puncture in the broad ligament beneath the ovarian ligament by means of an untied suture loop placed at the desired point on the round ligament. A broad approximation is then made of the round ligament loop upon the posterior uterine surface so as to avoid a rope-like sling; two linen sutures are sufficient. Another linen suture picks up the distal portion of the round ligament about an inch from where it enters the broad ligament and attaches it at the point of insertion of the ligament in the uterus. By this approximation the V-shaped gap in the outer portions of the broad ligament is eliminated. The normal direction of pull is maintained, and flexion is assured. All tension upon the posterior approximation is relieved, and no pessary and no elaborate uterine attachment, as practiced by some, are necessary.

Finally, the test of any operation for retrodisplacement is the cure of symptoms, and the ability to go through labor without recurrence. Many of my patients have had one or more pregnancies, and I have

not as yet met with a recurrence, but this I cannot say for any other type of operation which I have done.

In conclusion, I would emphasize the fact that every patient presents an individual problem and no matter what type of operation is used, it must be modified to meet the conditions present, rather than an attempt made to fit the patient's pathology to the operation, and to accomplish this, the best preparation is a thorough understanding of the fundamentals.

OAKLAND BANK OF SAVINGS BUILDING.

(For discussion, see page 432.)

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## CLOSTRIDIUM WELCHII SEPTICEMIA COMPLICATING PROLONGED LABOR DUE TO OBSTRUCTING MYOMA OF UTERUS, WITH REPORT OF CASE

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CASES of a puerperal septicemia due to the *Clostridium welchii* are sufficiently rare to warrant a report, especially if positive blood cultures were obtained during life. Forty-five cases have been reported of which 16 gave a positive blood culture antemortem. In the remaining cases, the diagnosis was made upon other clinical, pathologic, or bacteriologic findings.

The purpose of this paper is (a) to report another case of puerperal septicemia due to the *Clostridium welchii*; (b) to analyze the previously reported cases and attempt to draw therefrom a specific clinical picture, and (c) to review the more recent biologic findings of the *Clostridium welchii*, especially with reference to their bearing upon puerperal septicemia.

### HISTORICAL

The first case of puerperal infection due to the *Clostridium welchii* is that reported by Leduc<sup>1</sup> in 1597. The woman had been in labor for three days, and after a difficult extraction by means of a blunt hook, a violet colored gas escaped from the vagina. The woman died several days later.

Doleris<sup>2</sup> in 1891 reported a case very similar to our own. The woman was at term, and labor was very difficult, because of a complicating myoma. Forceps and cephalotripsy were attempted, but the fetus could not be delivered. The patient succumbed to a septicemia having its origin in an intense putrefaction of the uterine tissues, physometra, and putrid emphysema of the cellular tissues of the hypogastric region.

Graham, Stewart, and Baldwin<sup>3</sup> in 1893 reported the case of a woman who was seized suddenly with a chill which lasted four hours, and was followed by pain

in the region of the ovaries and uterus, by vomiting and purging. Thirteen hours after the onset she was emphysematous from the top of her head to the soles of her feet, and she died one hour later. Postmortem examination showed gas bubbles in the subcutaneous tissues and a small amount of gas in the peritoneal cavity. The abdominal veins were markedly distended with gas, and numerous bubbles of gas were found in all of the internal organs. The uterus gave evidence of a recent abortion. Bacteriologic examination showed the presence of *Clostridium welchii* in large numbers.

Dobbin,<sup>5</sup> in 1897, reported the first case in which the diagnosis of puerperal gas sepsis was made during life. The patient had a generally contracted pelvis and had been in labor for two days. On approaching the bed, he noticed a very sweetish offensive odor and heard a distinct continuous crackling sound coming from the vagina. After a difficult instrumental delivery, there was an escape of gas from the uterine cavity accompanied by an explosive sound. The placenta was delivered manually. The patient died four days after the onset of labor, and immediately thereafter the body began to swell. Seven hours after death the body was enormously inflated. From the mouth and nose there exuded a frothy, bloody serum, and from time to time large bubbles of gas could be seen to escape.

Krönig and Menge,<sup>4</sup> in 1894, reported two cases. The first was that of a primipara who could not be delivered, with forceps, and cephalotripsy was necessary. There was a foul discharge from the vagina. The temperature remained normal although *Clostridium welchii* was cultured from the uterus on the third day. On the ninth day the discharge was no longer foul, and the cultures were sterile. The perineal wound failed to heal normally. The fetus showed a generalized gas bacillus infection.

Their second case was that of a woman in difficult labor with prolapse of the cord. She was delivered on account of fever. The lochia was examined on the sixth day postpartum and showed numerous cocci and thick rods. The patient left the hospital on the ninth day. The fetus showed a generalized emphysema.

Little,<sup>6</sup> in 1905, reported 12 cases of puerperal infection, either due to the gas bacillus alone or associated with other organisms. The only case of this series which has any direct bearing on generalized gas infection is his ninth case, the history of which is as follows: febricula, normal labor, isolation of the *Clostridium welchii* from the uterus, blood culture positive for the *Clostridium welchii* on the fifth day postpartum, supravaginal hysterectomy, and isolation of the typhoid bacillus and the *Clostridium welchii* from the blood stream. Death occurred on the twenty-third day postpartum. Autopsy showed typhoid fever, infected abdominal wound, multiple abscesses of the kidney, acute splenic tumor, and healing ulcers of the small intestine. Of the remaining 11 cases of the series, one was Dobbin's case which is reported above; a second was a case of septicemia due to an unidentified anaerobic bacillus, and a third was a mastitis caused by the use of improperly sterilized water in hypodermoclysis and from which the *Clostridium welchii* was isolated. The other eight cases were localized infections of the uterus. Eight cases of the series followed operative procedures, two self-induced abortions, and in one case the organisms apparently entered the blood stream from their normal habitat in the intestines by way of the typhoid ulcers in the intestines. The *Clostridium welchii* was isolated in pure culture from the breast and from the uterus in two cases, and in the remaining cases it was associated with other organisms as follows: *Streptococcus pyogenes*, 4; *B. coli*, 2; *Staphylococcus albus*, 2; *Staphylococcus aureus*, 1; gonococcus, 1, and gram-positive diplococci, 1.

Whiteacre,<sup>7</sup> in 1906, reported a case of puerperal gas bacillus infection which followed criminal abortion and which simulated acute appendicitis. The onset was acute with vomiting, fever, diarrhea, and pain in the umbilical region which became localized to the right iliac fossa. At operation, on opening the peritoneal cavity, a considerable quantity of blood-tinged fluid escaped. The appendix was normal.

The patient died three hours after the operation or thirty-nine hours after the onset of the symptoms. The body began to swell one-half hour after death and showed typical gas bacillus changes, postmortem.

Young and Rhea,<sup>8</sup> in 1909, reported two cases which were characterized by a deep copper color of the skin which later darkened to a bronze. Case 1 gave a history of criminal abortion. The onset was sudden with pain in the abdomen, diarrhea, vomiting, chills, and bleeding from the vagina. She was admitted to the hospital on the third day of the disease with symptoms of prostration, restlessness, and vomiting. Physical examination showed a purplish discoloration of the tip of the nose, of the finger tips, and to a less extent of the toe nails. The rest of the body was of a deep bronze color. There was puffiness of the face and extremities; the white blood count was 25,000. Death occurred twenty-four hours after admission. Autopsy showed the usual gas bacillus emphysema. There was present, in addition, a perforation at the fundus of the uterus. The myometrium was dark red, moist, boggy, and crackled on pressure. The uterine cavity contained a considerable amount of grayish colored, seminecrotic material which was thickest and most firmly adherent over an area situated in the upper left portion of the posterior wall of the uterine cavity. The anatomic findings were perforation of the uterus (traumatic), endometritis, metritis, acute generalized peritonitis, and general septicemia due to the *Clostridium welchii*. Cultures taken from the uterus showed *Clostridium welchii*, *Staphylococcus albus*, and *B. coli communis*. Blood culture which was taken eighteen hours before death was positive for the *Clostridium welchii*.

In Case 2 the woman started bleeding after heavy exertion six days before admission to the hospital. On the next day the fetus was expelled. On the fifth day after the onset the entire body became jaundiced, and on admission she showed a jaundice with spots of purplish discoloration. The spleen was palpable. Temperature was 98.8° F., pulse 140, and white blood count 126,400. Death occurred four days after admission. Autopsy showed the changes typical of gas bacillus infection. "The uterus was enlarged and spongy to the touch." The myometrium was a light brown, and on section many gas bubbles escaped from it. The placental remains and blood clot were adherent to the uterine wall. The lower third of the endometrium had a distinct greenish hue. Cultures were negative.

Schottmüller,<sup>9</sup> in 1910, reported two cases. In Case 1 there was history of criminal abortion which was followed by chills and bleeding. The following day the patient had three chills with a temperature of 103.6° F. The *Clostridium welchii* was cultured from the blood and the cervix. The placenta did not have a foul odor. A second blood culture showed numerous colonies of the same organism. There were no further chills, the temperature returned to normal, and the patient was discharged as cured.

In Case 2 there was also history of criminal abortion, followed by bleeding. On the following day the patient had two chills, with a temperature of 100.6° F. Hippocratic facies were present. The *Staphylococcus aureus*, the *pneumococcus*, and the *Clostridium welchii* were recovered from the blood stream and from the cervix. Death occurred at the end of the second day. The placenta was very soft and had a foul odor.

Fraenkel,<sup>10</sup> in 1913, reported a case with the following history: The woman had missed her last menses, and the day before admission she became acutely ill and complained of pain over the abdomen. She showed on admission a peculiar pale gray color of the entire body and signs of peritonitis. Laparotomy, which was performed immediately, showed a large quantity of cloudy, bloody exudate in the peritoneal cavity. At the fundus of the uterus there were two bluish brown tumors, the size of oranges. Hysterectomy was done. The *Clostridium welchii* was cultured from the uterus and from the blood. Death occurred thirty hours after admission. On the anterior and posterior surfaces of the left half of the body of the uterus

there were present small round tumors which crepitated. On section the ovum and inner lining of the uterus appeared of a dirty brown color, and this discoloration extended almost to the outermost zone of the uterus. The cervix did not show any gas. Methemoglobin was found in the urine and in the blood.

Bingold,<sup>11</sup> in 1914, reported 130 cases of puerperal infection associated with the *Clostridium welchii* and divided them into the following clinical groups: (a) The localized endometritic type. Here the infection remains localized to the endometrium, is well walled off, usually runs a symptomless course, and practically always ends in recovery, although the organisms may occasionally enter the blood stream by mechanical methods. (b) The lymphangitic type. Here the infection is in the uterine musculature, spreading by way of the lymphatics to the peritoneum and blood stream. This group is always attended with serious symptoms and may end fatally. (c) Thrombophlebitic type. Here the infection spreads by way of the veins and is accompanied by frequent chills. The occurrence of anaerobic streptococci in the latter type would seem to throw doubt upon the *Clostridium welchii* as being the causative agent in this type of infection.

Cherry,<sup>12</sup> in 1919, reported a case of gas bacillus infection with the following clinical history: Fetal movements were not felt for four weeks. After an interval of four more weeks a Ribes' bag was introduced to induce labor. Thirty-four hours afterward, as no labor pains resulted, a larger bag was introduced. Forty hours after the insertion of the first bag, the patient had a chill and fever. Forty-eight hours later she had an attack of severe nausea and vomiting and suddenly died. Autopsy showed the presence of a dead fetus, and smears from the uterus showed *Clostridium welchii*.

Matthews,<sup>13</sup> in 1922, reported a case of criminal abortion which was followed twenty-four hours later by bleeding, chills, and vomiting. Forty-eight hours later, on admission to the hospital, the patient was found to be acutely ill, jaundiced, and cyanotic. There was a moderately tender infiltration in the left fornix but more extensive and more sensitive in the right fornix. Red blood cell count, 3,000,000; white cell count, 51,200; polymorphoneutrophils, 89 per cent; temperature, 104.1° F.; pulse, 120. The outstanding symptoms during her stay in the hospital were numerous chills, cyanosis, and elevation of pulse and temperature. There were marked mental involvement and emphysema of both inguinal regions. Death occurred one hundred and nine hours after introduction of the slippery elm stick. Autopsy showed in addition to the typical changes of *Clostridium welchii* septicemia, a soft uterus which contained placental remains. Gas bubbles were found over the surfaces of the uterus and broad ligament. Blood culture was positive for *Clostridium welchii*. Cultures from the uterus gave the *Clostridium welchii*, *B. proteus*, and staphylococcus. The peritoneal fluid showed *Clostridium welchii* in pure culture.

Gemill,<sup>14</sup> in 1924, reported a case of criminal abortion which was followed in three days by severe pain in the lower abdomen and by the passage of a large number of clots from the vagina. On physical examination she was practically pulseless, the brow was covered with a cold sweat, the right arm had red lines over the triceps muscle, and crepitation could be elicited from the elbow to the shoulder girdle and to a less extent on the flexor surface of the forearm. Foul necrotic material was obtained from the cervix. Red blood cell count, 4,865,000; white blood cell count, 10,400; polymorphoneutrophils, 63 per cent; albumin, 4-plus, and many granular casts. Blood culture was negative. Death occurred five hours after admission. Autopsy showed general emphysema; the spleen was enlarged and soft; the uterus was soft and gangrenous, and contained remnants of placenta.

Lehmann,<sup>15</sup> in 1924, was able to add to a case report details of treatment which saved the patient's life, and shortly afterwards in collaboration with Fraenkel he published it in connection with 4 additional cases.

The following are also included in our statistical study: Welch and Flexner,<sup>16</sup> 1 case; Ernst,<sup>17</sup> 1 case; Halban,<sup>18</sup> 1 case; Lenhartz,<sup>19</sup> 1 case; Stokes and Wright,<sup>20</sup>

1 case; Scheidler,<sup>21</sup> 2 cases; Owen and Glynn,<sup>22</sup> 1 case; Wanekros,<sup>23</sup> 1 case; Rosensohn,<sup>24</sup> 1 case; Hunt,<sup>25</sup> 2 cases; Estol and Hormasche,<sup>26</sup> 1 case; Simon,<sup>27</sup> 3 cases; Heim,<sup>28</sup> 2 cases; Schulz,<sup>29</sup> 1 case; Heim,<sup>30</sup> 1 case; Noltmann,<sup>31</sup> 2 cases; Henyemann,<sup>32</sup> 1 case; Bondy,<sup>33</sup> 1 case; Simonds,<sup>34</sup> 3 cases; Brutt,<sup>35</sup> 1 case; Ford and Lawrence,<sup>36</sup> 2 cases; Coenon,<sup>37</sup> 1 case, and Lehmann and Fraenkel,<sup>38</sup> 1 case.

#### REPORT OF CASE

C. H. B., colored, aged thirty-two, para i, was admitted to Maternity Division, Memphis General Hospital by ambulance on July 27, 1926, with a history of having been in labor for three days. She was first attended by a midwife for two days who, when labor failed to terminate spontaneously, called a physician. Attempt at delivery by version and extraction was unsuccessful; during the operation, however, the left arm and shoulder were disarticulated and removed.

Upon admission to the hospital examination revealed a fairly well-developed female. Temperature 101.4; pulse 170; respiration 60. She was perspiring freely; there was dryness of the mucous membranes, and cyanosis; she was restless and presented an anxious appearance. No heart tones were audible, and the uterus was in tetanic contraction. Vaginal examination showed a transverse presentation with fetal back over the inlet, the head and right shoulder in the left flank, and the buttocks in the upper right quadrant; the presenting part was crowded firmly against the inlet; the cervix was completely dilated, and the bladder and rectum were empty. The mother was in only fair condition, but delivery seemed indicated, and the method chosen was version and extraction.

Under deep ether narcosis an attempt was made to disengage the presenting part. Relaxation of the uterus could not be obtained, and evisceration was resorted to; the version was then completed without difficulty and was followed by extraction of the body. The fetal head could not be engaged in the inlet; it was evacuated and delivered with the cranioclast.

Immediately after the operation the patient received 1000 c.c. of normal saline solution with 500 c.c. of 5 per cent glucose by hypodermoclysis. Morphine, gr.  $\frac{1}{6}$ , was administered along with digitan and caffeine sodiobenzoate alternately every four hours.

The following morning the patient showed slight improvement. The placenta, which had not been expelled at the time of the operation, was removed manually. Upon removing the placenta which was found closely adherent to the anterior wall of the fundus, a large tumor-like mass was encountered on the left wall of the lower segment which greatly obstructed the inlet. At this time blood and intra-uterine cultures were taken.

The third day postpartum was begun with a transfusion of 300 c.c. of whole blood. The patient's condition was serious. The twenty-four hour blood and uterine cultures showed *Clostridium welchii*. An hysterectomy was done under local anesthesia, and the patient succumbed at 5 P.M.

*Laboratory Findings.*—Red blood cells, 3,000,000; white blood cells, 14,506; neutrophils, 84; lymphocytes, 14; large mononuclears, 2; hemoglobin, 60 per cent; Kahn test negative (7/30); urine on the first day postpartum, showed blood, albumin, pus, and amorphous sediment.

*Bacteriologic Findings.*—Blood culture taken on July 29 showed within eighteen hours, a gram positive, nonmotile bacillus from the anerobic media. One cubic centimeter of a twenty-four hour broth subculture was inoculated into the ear vein of a rabbit which was killed after five minutes and then incubated for six hours. At this time the rabbit showed bilateral exophthalmos and generalized subcutaneous emphysema. The edematous subcutaneous tissue everywhere contained bubbles of gas, and in areas showed a bright red, greenish, or yellowish discoloration. On entering the peritoneal cavity a large amount of gas escaped. The liver



and kidneys, which were similar in appearance, were opaque, brown, very friable, and filled with gas. The left lung was a reddish brown. The right lung was normal in appearance. The heart had a dull, opaque, brown appearance. Hemolysis, gas, and serum were present in all the tissues, such as muscle, fat, etc. Cultures from the heart's blood and from the liver were positive for *Clostridium welchii*. The capsule was demonstrated by Huntoon's method. Spores were seen in cultures from alkaline egg media. Milk showed the characteristic, stormy fermentation due to the rapid acidification and coagulation with the production of a large amount of gas. Hemolysis was shown on the blood plate, and inulin and glycerin were fermented, the organism belonging, therefore, to group one.<sup>34</sup>

Cultures from the uterus on July 30 gave *B. coli communis*, *Staphylococcus albus*, and *Clostridium welchii*.

*Pathologic Findings.*—Only a partial autopsy was permitted. On the day of death the external examination of the body showed a marked generalized subcutaneous emphysema. The conjunctivae were intensely yellowish green. Gas bubbles escaped from the nose and mouth. The vulva crepitated, was swollen, and succulent. The skin was excoriated or came away leaving a hemolytic lower surface. The inner wall of the vagina was gangrenous and of many colors, being similar in appearance to the wall of the uterus previously described.

The uterus was greatly enlarged, weighing 530 grams; the left tube was bound down by a few fibrous adhesions to the surface of the uterus; the right tube was more extensively bound by fibrous tissue to its ovary and to the side of the uterus. There were fibrous tissue tags over the entire surface of the uterus. The uterus was somewhat distorted by the presence of a number of small subserous and intramural myomas, which on section, gave the usual appearance. On being opened the inner surface and the greatest part of the wall and the fundus of the uterus, even reaching the peritoneal covering, was mottled, reddish brown, dark green, yellowish green, opaque, autolytic, friable, and foul smelling. Gas bubbles escaped on pressure. Near the internal os there was a large intramural myoma, 10 cm. in diameter, which projected into the uterine cavity. The outer surface had an icteric tint.

Microscopic examination of the wall of the uterus at the cervix and in the fundus and also of the obstructing myoma showed extensive necrosis of the endometrium and underlying muscle fibers, arteries, veins, nerves, and fibrous tissue. In places were seen small and large spaces which had been filled with gas and in whose wall were seen in large numbers various types of bacteria, including a large round end bacillus, obviously the *Clostridium welchii*. Serum albumin and extracellular hemoglobin in large amounts were seen between the necrotic tissue fibers. Congestion was marked. The absence of leucocytes was conspicuous. Only small groups of polymorphonuclears were seen in places.

*Anatomic Diagnosis.*—Puerperal uterus with obstructing myoma and gas bacillus infection.

#### DISCUSSION

A study of 41 cases of puerperal septicemia due to the *Clostridium welchii* which we have selected for detailed analysis, reveals the following facts:

*Nature of Pregnancy.*—We find that according to the underlying pathology attending pregnancy we can subdivide these cases into: (1) the abortion group comprising 60.97 per cent of the total number of cases, and (2) the nonabortion group, comprising 39.03 per cent. The nonabortion group can be further subdivided into the following subgroups: (a) contracted pelvis 7.29 per cent; (b) obstruction due

to myoma 2.43 per cent; (c) protracted labor 7.29 per cent; (d) death of the fetus 2.43 per cent; (e) transverse presentation 7.29 per cent; (f) breech presentation 2.43 per cent; (g) normal 7.29 per cent; and (h) unclassified 2.43 per cent.

*Method of Delivery.*—In the nonabortion group we find that the first stage of labor is prolonged in all but 4.87 per cent of the total number of cases. In this group also the pathology which was present in all but 4.87 per cent of the cases was of such a nature that it favored frequent vaginal examinations and various operative procedures. Vaginal examinations and operative procedures serve as the means of introducing into the uterus the *Clostridium welchii*, which is not normally present in the uterus according to most investigators. Schottmüller,<sup>9</sup> on the other hand, claims that it may be occasionally found in the vagina of normal healthy women and that autoinfection is possible.

Furthermore, both criminal abortions and operative procedures favor the implantation and the multiplication of the *Clostridium welchii* in the uterine tissues by the trauma and necrosis which they bring about, and it is well known that dead tissue with its deficient supply of oxygen is necessary before the implantation, and especially the propagation, of the organism can be successful.

The prodromal period was found to be within forty-eight hours in 70 per cent of all cases and within twenty-four hours in practically 50 per cent of all cases.

*Duration of Sepsis.*—This is the interval from the time of infection to the time of death. Recoveries took place in 13.16 per cent, and the majority of these patients had immediate hysterectomies performed; 10.53 per cent died within twenty-four hours; 23.68 per cent died between twenty-four and forty-eight hours; 15.79 per cent died between forty-eight and seventy-two hours; 13.16 per cent died between seventy-two and ninety-six hours; 5.26 per cent died on the fifth day; 2.63 per cent on the sixth day; and the same percentage died on the seventh, eighth, tenth, eleventh, eighteenth, and nineteenth days respectively. In cases where there were many possibilities of infection, we have taken the earliest date as the one of infection, and thus our figures may tend to be higher than actually is the case. Nevertheless, it will be seen that the puerperal septicemia caused by the *Clostridium welchii* is very fulminating in character. Over one-third of the patients die within forty-eight hours after infection has taken place, and over one-half within four days; but with the early recognition of the disease and the extirpation of the uterus, as shown by Brutt<sup>35</sup> and by Heim,<sup>28, 30</sup> the mortality rate may be reduced considerably. A combination of the extirpation of the uterus (since a debridement is impossible in the case of the uterus) with administration of the specific

serum would seem to us to be the most logical and successful method for the treatment of puerperal septicemia due to the *Clostridium welchii*.

*Symptoms.*—In two cases, or 4.87 per cent, the first and only symptoms were those suggestive of air embolism. In Scheidler's<sup>21</sup> case, four days after delivery the patient had sudden difficulty in breathing and died immediately. In Hunt's<sup>25</sup> case, twenty-four hours after performing abortion and while attempting to repeat the act, the patient had a convulsion and died.

Vomiting occurs in 47.37 per cent of the cases and is usually an early symptom; pain in the abdomen occurs in 55.6 per cent; chills in 34.21 per cent; diarrhea in 21.06 per cent, and convulsions in 5.26 per cent.

Pain in the abdomen, especially in the abortive group, is the earliest and most frequent symptom encountered. Vomiting usually occurs at the onset of the disease and then disappears, but occasionally may be present throughout the course; diarrhea may appear early or late.

The skin was described as a grayish blue in 5.26 per cent; as grayish green in 2.64 per cent, and as a pale gray in 2.62 per cent of cases.

Red lines over the triceps muscle were present in one case, or 2.63 per cent.

Puffiness of the face was noted in 5.26 per cent of the total number of cases.

Jaundice occurred in 50 per cent of the total number of cases. It appeared as early as twenty-four hours after infection in 16.6 per cent of the cases showing this symptom. On the second day in 44.4 per cent; on the third day in 5.5 per cent; on the fifth day in 22.2 per cent; on the sixth day in 5.5 per cent, and on the eighth day in 5.5 per cent. It is thus seen that jaundice, when it is present, usually occurs very early in the disease, for 60 per cent of the jaundiced cases showed it within forty-eight hours. It appeared as a mild jaundice which, however, deepened rapidly, so that the descriptions of mahogany-colored, bronze-colored, and dark as a hottentot occurred frequently.

Cyanosis occurred in 42.12 per cent of the cases and usually followed the jaundice, although in one case mention is made of cyanosis without jaundice.

The jaundice is due to the hemolysis of the red blood cells by the hemotoxin liberated by the *Clostridium welchii* as was first shown by Ford and Lawrence.<sup>36</sup> Fraenkel<sup>10</sup> still maintains that the hemolysis is due to absorption of toxic products from the necrotic tissues. Heim<sup>30</sup> cites a case, in favor of Fraenkel's theory, in which after the infected uterus had been removed, the hemolysis of the red blood cells still continued but ceased after blood transfusion. Cyanosis is due to the lack of sufficient red blood cells to carry on the usual oxygen exchange

necessary for the metabolic processes of the body. Air hunger which is usually present is also due to the same cause.

Jaundice, therefore, is one of the most important diagnostic signs of *Clostridium welchii* septicemia. A jaundice which appears early and progresses rapidly, and whose final color scheme is a combination of the yellow of jaundice and the blue of cyanosis occurs only in the puerperal infection caused by the *Clostridium welchii*.

Emphysema of the skin occurred in only 16.59 per cent of the cases. In only 4.74 per cent of the cases was there a generalized emphysema present, such as is seen in gas phlegmon of the extremities. In the remaining cases the emphysema was usually localized and usually terminal.

Changes in the uterus were observed in 13.15 per cent of the cases. In 10.52 per cent there was present tympani uteri and in 2.63 per cent physometra uteri. Thus, it is evident that gas formation in the uterus and in the skin is infrequent, especially when contrasted with the constant occurrence of gas in *Clostridium welchii* infection of the extremities.

*Laboratory Findings.*—The urinary findings that are given show that albumin is present in 19.04 per cent, sugar in 4.7 per cent, hematoporphyrin in 4.76 per cent, methemoglobin in 28.56 per cent, oxyhemoglobin in 28.56 per cent, hematin in 9.52 per cent, and hyaline or blood casts in 38.08 per cent. The urine is usually scanty and obtained by catheterization. White blood cells and red blood cells are found in small numbers in the sediment, but in many cases the hemolysis may be so complete that only the shreds of the red blood cells are found. Here again we have the hemotoxin of the *Clostridium welchii* showing its effects by the laking of the red blood cells, and the excess of the blood pigments excreted by the kidney. Fraenkel<sup>10</sup> noticed a true nephritis in one case, but usually the findings are those of irritation of the kidney parenchyma by the excess of the blood pigments.

*White blood cell count:* The white blood cell count is between 10,000 and 20,000 in 33.33 per cent of the cases; between 20,000 and 30,000 in 16.66 per cent of the cases; between 30,000 and 40,000 in 8.33 per cent; between 50,000 and 60,000 in 16.66 per cent; between 60,000 and 70,000 in 8.33 per cent; between 70,000 and 80,000 in 8.33 per cent, and 125,000 in 8.33 per cent.

*The red blood cell count* is normal in 25 per cent of the cases; between 3,000,000 and 4,000,000 in 25 per cent; between 1,500,000 and 2,000,000 in 50 per cent.

In 50 per cent the hemoglobin was between 40 and 50 per cent; in 28.57 per cent between 50 and 60 per cent, and in 42.85 per cent between 20 and 30 per cent.

It is thus seen that the laboratory findings give us very valuable aid in the diagnosis of this infection. In a typical case we should

find scanty, blood-tinged urine containing changed blood pigments, an elevated white blood count, and a rapidly progressive severe secondary anemia. Thus Fraenkel and Lehmann<sup>38</sup> actually observed the red blood cell count sink from 4,200,000 to 3,100,000 to 2,100,000, and the hemoglobin from 70 per cent to 50 per cent to 30 per cent in the course of six hours. Heim<sup>30</sup> emphasizes the finding in the puerperal blood of pathologic bone marrow cells which he claims are only observed in cases of perinicious anemia and gas bacillus sepsis.

*Temperature.*—The temperature was subnormal in 8.33 per cent of the cases. In 11.11 per cent it was normal, and in the remaining it was elevated, but no definite conclusions can be drawn as to a specific temperature curve.

*Bacteriologic Findings.*—In 16 cases a positive blood culture was obtained during life. It occurred together with the typhoid bacillus once, with anaerobic streptococci once, with staphylococcus and pneumococcus once, and with *B. coli* once. In the uterus it was found in 19 of the 41 cases reported. In 9 of these cases it occurred in pure culture; with *Staphylococcus aureus* in 3 cases; with *Staphylococcus albus* in 1; with streptococcus (unclassified) in 1; with *Streptococcus pyogenes* in 5; with anaerobic streptococcus in 1, and with *B. coli* in 5.

The organism occurs in human and animal feces, in naturally fertilized soil, garden soil, street dirt, and on anything that may be soiled thereby, such as clothing, tools, etc. When introduced into the puerperal uterus, it may call forth the following conditions: (1) emphysema of the fetus, (2) puerperal endometritis, (3) physometra, (4) emphysema of the uterine wall, and (5) gas sepsis. Fraenkel groups the first three conditions under the head of tympani uteri and the latter two under the head of physometra uteri. If the condition remains localized to the ovum or to the endometrium and is well walled off, the symptoms may be slight, and the patient usually recovers even though the organism is found in the blood stream. It is, however, when the organism gains entrance into the uterine musculature that the condition becomes serious. In the latter case the organism lodges in the lymph spaces between the muscles and in the lymph spaces of the vessels because of their poor content of oxygen. Then they cause necrosis of the tissues in their neighborhood. Around this necrotic area, we have a peripheral edematous zone due to the extravasation of the blood from the necrotic vessels and its subsequent hemolysis by the hemotoxin. Polymorphonuclears are kept away by a leucocidin liberated by the organism. By way of the lymph stream the organisms are discharged sporadically or continuously into the blood stream, thus giving rise to the picture of gas septicemia. Owing to the oxygen content of the blood, we cannot assume that the organisms multiply there until just before death when with failing circulation the oxygen content of the blood is greatly diminished.

The frequent occurrence of jaundice in gas septicemia and its comparative rarity in gas phlegmon can be explained by the richness of the puerperal uterus in blood and lymph vessels which afford an easy path for the absorption of the hematoxins. The question of the part that the *C. welchii* and other organisms play in each case must necessarily remain an open one, although there is bacteriologic proof that in one case at least the *C. welchii* died out and death was caused by another organism.

#### CONCLUSIONS

1. A summary of the recorded cases shows that abortion is the most important cause in the etiology of gas bacillus infection.

2. Pain in the abdomen, fever, rapid pulse, jaundice, cyanosis, air hunger, hemoglobinuria, hemoglobinemia, rapidly progressive secondary anemia with pathologic bone marrow cells in the circulating blood form the clinical entity for the diagnosis of gas bacillus sepsis.

3. Hysterectomy, administration of antitoxin, and blood transfusion seem to be the most logical method of treatment.

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# IS THE EXPECTANT PLAN OF TREATING HYDATIDIFORM MOLE JUSTIFIED?

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CYSTIC degeneration of the villous processes of the chorion, commonly called hydatidiform mole, is the most frequent, as well as the most dangerous morbid alteration of the ovular envelop. This rather unusual type of neoplastic disease is almost invariably accompanied with an embryonal death rate of 100 per cent, and one patient out of every eight or ten dies, either as a direct result of the associated hemorrhage or indirectly from chorionepithelioma, the most fatal type of epithelial malignancy.

Though placing the maternal mortality of hydatidiform mole at a relatively low point, I am not unmindful of the much higher figures set forth in the standard works on gynecology and obstetrics. The recorded maternal mortality is consistently fixed at from 20 to 25 per cent and, in the final analysis, these figures may not be far from the mark.

Notwithstanding a discrepancy in statistics of 5 per cent or more, it is obvious that no other disease complicating pregnancy, except perhaps septic infection, is accompanied with a higher percentage of maternal deaths.

It is highly probable that chorionic malignant disease rarely, if ever, arises independently of hydatidiform mole, although molar degeneration may not be recognized or even suspected.

Probably a larger number of moles than the accepted 5 per cent become malignant. Primary malignant degeneration of the placenta is exceedingly unlikely, and I am persuaded that hydatidiform disease is the precursor of chorionic carcinoma in nearly all cases.

Typical chorionepithelioma follows some type of pregnancy invariably, and in the majority of instances, as is well known, it follows vesicular mole.

The next condition in point of frequency is abortion, but this statement must be accepted with some qualification. It is extremely important to determine whether those cases designated as abortion fulfilled completely the condition embodied in that term. Were all cases so recorded, thoroughly studied from the gross as well as the histologic aspect? Is it not likely that many of the cases were casually recorded as simple abortions? Is it not possible that some contained concealed or microscopic evidence of early vesicular degeneration?

Meyer believes that hydatidiform mole is an extremely uncommon condition at or near term, but he regards it as the most frequent of

all diseases of the ovum during the early weeks of pregnancy. This investigator claims that from 4 to 10 per cent of all pregnancies are complicated by some degree of hydatidiform degeneration. The determination of the frequency of the trouble, he claims, depends on the care with which all specimens are examined.

As regards the malignant transformation of hydatidiform mole, Teacher found this disease arising after mole in 36.6 per cent and after abortion in 31 per cent of cases. In 240 cases of chorion epithelioma, Hitchmann and Cristofolletti found malignancy following mole in 48.3 per cent and after abortion, in 73 per cent of cases. These observations, referred to by nearly all writers, were made more than twenty-five years ago, and they are not without significance.

In view of the extensive investigations and findings of Meyer, it seems rational to assume that many of the cases simply registered as abortions were in reality early moles. It is almost inconceivable that a simple uncomplicated abortion could act as the progenitor of malignant disease.

In this connection, it may be of interest to recall that nearly all cases of mole are treated primarily as threatened or inevitable abortions. The few recorded cases of chorionepithelioma developing during pregnancy may represent the sequel of primary hydatidiform mole, and this may likewise apply to those rare cases following tubal gestation.

In a personal case of the latter type, I was able to demonstrate without difficulty numerous small cystic bodies in the tumor mass, and in studying a similar case of a colleague, I found plain signs of associated cystic disease. Most observers contend that hydatidiform mole, so far as malignant degeneration is concerned, does not reach the figure of 5 per cent, or the maternal mortality the high point of 20 or 25 per cent as recorded in the literature. Why this attitude is assumed, I am unable to understand, for I am convinced that the figures mentioned are in almost strict accord with the clinical history of the disease.

Since this paper is designed primarily to consider the treatment of hydatidiform mole, many other interesting phases of the trouble cannot be included in this discussion. In order, however, to present the subject in a systematic manner, I have found it necessary to incorporate certain features of the condition besides its treatment.

With reference to the historical aspect of hydatidiform mole, it might be of interest to mention that, while the disease was first described by von Graefenberg in the latter half of the sixteenth century, special interest was not aroused until the publication of the paper of Madame Boivin, one hundred years ago, 1827. However, it was not until the beginning of the nineteenth century that the lesion was finally recognized as a degenerative process of the chorionic villi.



There is now, as Schumann states, "a rich and voluminous literature relating to the genesis and pathology of these growths, though the management of the condition has excited but scant comment."

With reference to the etiology of the disease, nothing is definitely known. Many predisposing causes, as age, time of occurrence, multi-gravity, and the association of lutein cysts are mentioned, but the actual causation of the trouble is wholly obscure.

With our present knowledge regarding the association of lutein cysts, structure at times assuming an attitude of aggression, at other times, one of regression, it is impossible to determine whether their presence be incident to the pregnancy or coincident to the pathologic alteration in the chorion. That lutein cysts may be etiologically related is possible, but thus far no legitimate proof that they are actually causative has been presented. To stand the test of etiologic relationship, they should be at least a fairly constant and not an occasional accompaniment of hydatidiform mole or its most common sequel, chorionepithelioma.

Hydatidiform disease is still looked upon as one of the uncommon complications of pregnancy, but it must be admitted that the trouble is much more frequent than formerly believed. Opportunity is not afforded many individuals to study a large series of cases. Even for one in active obstetric work opportunity for study is limited. Probably not more than ten or fifteen cases of the gross type of the disease come under one's observation, yet it is not too much to say that one or more out of the number thus observed terminate in chorionepithelioma.

A study of the literature of so-called simple benign mole with reference to its frequency discloses a wide gap. Accurate figures respecting its incidence are not forth coming, but modern writers believe the condition occurs with much greater frequency than was formerly taught.

Madame Boivin, writing in 1827, to whom nearly all authors refer, claimed the disease arose once in twenty thousand pregnancies.

Freund placed the complication at a similar figure. Broadhead and Kassebohm, in a study of 12,030 cases of labor and abortion, found six moles, or one in 2,000. Gordon, in a study of 4,500 abortions in Bellevue Hospital, New York, found twenty-one cases of mole, or one in 214. In a series of 348 pathologic abortions, this writer found hydatidiform degeneration in 43 per cent.

In 8,187 maternity patients, Velasco discovered forty typical examples of hydatidiform mole in 205, or 5 per cent.

Meyer, in analyzing 2,589 abortions in the Mall collection, found on gross examination alone eight specimens of mole, or one in 261 cases.

Storch, quoted by Frank, in an examination of a large series of unselected abortive ova, found 75 per cent showing cystic degeneration. A study of the recent literature indicates a growing conviction that the condition is more frequent than heretofore believed.

Reference has already been made to the relationship of hydatidiform mole and chorionepithelioma, and to no subject in gynecologic or obstetric pathology, except perhaps uterine cancer and puerperal infection, has more critical investigation been devoted. As a result a voluminous literature has arisen, especially with reference to the influential rôle hydatidiform mole bears to malignant degeneration of the placenta.

Up until 1921, there were recorded in the literature 587 cases of this type of malignant disease, and in a comparatively recent study covering a period of three years, I found recorded twenty-five additional cases, making a total of 612. These figures, I am quite confident, do not represent by any means the total number of cases that have occurred.

Pallosson and Violet, in studying the relation of hydatidiform mole to chorionepithelioma, found 203 cases, or 44 per cent, in 455 specimens examined.

Of 500 cases of mole collected by Findley, 157, or 31.4 per cent, became malignant.

Kerr believes hydatidiform mole precedes chorionepithelioma in 50 per cent of the cases, and of Teacher's well-known series of 188 cases, 74, or 39.3 per cent, were preceded by molar disease.

The mortality of vesicular mole depends: first, somewhat on the stage of pregnancy at which the tumor begins; second, on the invasive nature of the growth and, third, on its benign or malignant character.

In the 500 cases collected by Findley, there were 265 designated as benign; of this number 237 of the patients recovered and 28 died, a mortality of 10.5 per cent. Ninety-nine patients developed secondary malignancy. Forty-five of these recovered and fifty-four died, a mortality of 54.5 per cent.

In a series of sixty-eight cases of mole recently recorded in the literature, the ultimate result was mentioned in sixty-four. Fifty-eight of the patients recovered and six died, a primary mortality of 9.4 per cent. The cause of death was attributed to hemorrhage in four, two of which were associated with perforation and rupture of the uterus. One patient died of peritonitis and one of secondary chorionic malignancy.

With regard to the mortality rate as indicated in the literature, it is figured as low as 9 per cent by Gordon and as high as 26 per cent by Williamson. Provided all patients receive intelligent care, probably a primary mortality of 10 per cent could be looked upon as a fair minimum and 15 per cent as a fair maximum, exclusive of secondary malignancy.

*Treatment.*—Although active measures in the treatment of hydatidiform mole have from time to time been advocated, a policy of tardy expectancy is still usually adopted. This rather complacent attitude has not altered during the last half century. A disease associated

with a primary mortality of 10 or 15 per cent with an added mortality from secondary malignancy calls for more intelligent, if not more drastic therapy.

Schumann, in a paper published in 1922, claims it is rational to regard every hydatidiform mole clinically as malignant, to which no halfway measures are applicable. He advocated removal of the uterus with the tumor through an abdominal incision. This plan has not met with approval. Schumann does not stand alone as the sole proponent of the radical method, nor was he the first to bring it to the notice of the profession. Many years ago the procedure was suggested by Freund. It has been approved by Essen-Möller and supported by Howard Taylor, especially in those cases associated with bleeding, in patients with rigid cervixes and those approaching the menopausal years.

In extenuation of the radical plan advocated by the writers named, it must be said that they are largely justified in their premise, since no other condition complicating pregnancy carrying a like mortality would be treated by sheer complacency, the means commonly employed today.

The expectant method of treatment is not founded on a scientific basis. *Expectancy is almost analogous to helplessness. Tardiness has not served to mitigate the primary mortality of the disease nor thwart the development of secondary chorioneplithelioma with its widespread metastasis. No disease of a potentially malignant nature, one of the chief characteristics of hydatidiform mole, is amenable to a policy of watchful waiting.*

While personally I am not prepared to adopt the ultra radical plan suggested by the writers named, I am nevertheless fully convinced that the present mode of therapy needs revision. It should be governed, it seems to me, as other forms of neoplastic disease, by the revelations of the microscopic and not by the subsequent clinical course of the growth.

Every mole expelled should be followed by a careful curettement of the uterine cavity. This recourse should be instituted irrespective of whether the expulsion be partial or complete. The material removed, as well as that expelled spontaneously, should be subjected to the most exhaustive microscopic examination.

Abnormal activity in Langan's cells (Fig. 1) should constitute the guide for further treatment. Simply curetting the uterus combined with a course of wait-to-see-what-may-happen does not provide the necessary factor of safety.

To be governed by recurrent or persistent bleeding, a custom practiced hitherto, is not scientific nor is it justified. The advent of secondary hemorrhage is always exceedingly significant, if not really ominous. Recurrent bleeding may be an expression of a hyperplastic

process in the endometrium, but in some instances it is an expression of secondary malignancy. In still other cases it may be due, as pointed out in a very splendid paper by Rosenzweig, first, to syncytial endometritis and, second, to syncytioma.

Although it is said there is no cell type of hydatidiform mole to indicate its benign or malignant character, evidence is gradually accumulating to show that this conception is somewhat in error.

Doctors Crawford and Bucher, pathologists in Jefferson Medical College Hospital, from studies of the specimen expelled by the patient,



Fig. 1.—Section from an expelled mole, showing the presence of villi and marked proliferation of the epithelium.

Mrs. A. F. S. (Fig. 1), made a tentative diagnosis of incipient chorion-epithelioma. These microscopists were so positive as to the nature of the growth that they even recommended immediate hysterectomy. This advice was not heeded. The usual plan of wait and watch was followed.

Four weeks after expulsion of the mole the patient again came under observation complaining of discomfort about the vaginal orifice. An examination disclosed two masses the size, color, and consistency of the common blue plum. One of the tumors occupied the

midsection of the anterior vaginal wall, and the other was located immediately within the vulvar orifice in the posterior vaginal wall.

This patient was readmitted to the hospital and a hysterectomy was performed; the vaginal growths being removed at the same time by means of the cautery knife. The vaginal tumors, were submitted to the pathologist and were reported as typical examples of chorion-epithelioma. (Fig. 2.) A microscopic examination was made of several sections of the uterine body, but curiously this did not show more than an atypical syncytial invasion of its wall.



Fig. 2.—A portion of the growth removed from vaginal wall.

This single example of rather characteristic cellular alteration in a hydatidiform mole would seem to disprove the assertion of certain writers, notably Caturani, that there is no cell type to distinguish the premalignant growth, if I may use that very much abused term. Doctors Crawford and Bucher regarded the growth as approaching the malignant type, basing their histologic diagnosis on the extraordinary activity of Langhans' cells.

In this connection it may be important to recall that Caturani, who has devoted considerable study to the clinical aspect and cellular architecture of moles, refers to certain features which might enable one to determine their true oncologic nature. Specimens in which

features of the primitive chorion are reproduced in the cystic mass, he always views with suspicion. Signs of a malignant propensity are also indicated to a certain extent, in those tumors displaying a tendency to invade the myometrium. The latter types hitherto regarded, I believe, as the transitional stage of a benign mole to a malignant chorioma are now, according to Ewing, Rosenzweig, and others, looked upon essentially as benign growths.

This observation may explain those rare instances of spontaneous cure of certain growths recorded as malignant and characterized by perforation of the uterine wall, bladder infiltration and, even pulmonary metastasis.

Finally, is the customary plan of expectant treatment of hydatidiform mole justified? From the varied clinical and pathologic aspects of the disease, this question must be answered in the negative. To meet the premise of sound therapeutic philosophy, the means employed should be governed by the judgment of an expert pathologist. It should be based on the pathology rather than on the clinical behavior of the growth.

The following abstracts of ten case histories collected from our hospital files portray some of the clinical and pathologic features of hydatidiform mole.

CASE 1.—Mrs. M. D., aged thirty, nullipara, admitted to Jefferson Hospital with a history of irregular bleeding following an amenorrhea of three months' duration. Forty-eight hours after admission she expelled a large mole. This was submitted to microscopic study and was reported benign. Two months later the patient returned to the hospital complaining of more or less persistent bleeding and a diagnostic curettage was performed.

The tissue thus removed consisted of organized blood and a few grape-like cysts. From the fragmentary character of the blood combined with the cystic bodies, it was thought wise to perform an exploratory hysterotomy. On exposing the interior of the uterus, there was found in the left posterolateral wall a necrotic mass three centimeters in diameter. The uterine incision was closed and a complete hysterectomy was immediately performed. Section of the uterine body disclosed several small cysts penetrating the myometrium, and two of these were found hanging from a perforation in the left uterine wall. Sections of the tumor were studied, and a diagnosis of chorionepithelioma was returned.

Nine months later, the patient again came under observation complaining of vague pain in the left side of the pelvis. On bimanual examination a soft globular mass, the size of a small orange, was located in the left pelvic cavity. An exploratory posterior vaginal incision was made. Manipulation of the tumor provoked violent hemorrhage, from which the patient almost immediately succumbed. Some of the tissue, grossly resembling organized blood, removed through the posterior vaginal incision was submitted to microscopic study and proved to be, as was suspected, recurrent chorionic malignant disease.

CASE 2.—Mrs. F. S., aged thirty-seven, para i. The patient was admitted with a history of irregular bleeding following an amenorrhea of three months' duration. Bleeding began after an eight weeks' amenorrhea. Twelve hours after admission, the patient expelled a large hydatidiform mole. Microscopic examination of the specimen disclosed extraordinary activity of Langhans' cells. The pathologist looked upon the tumor with grave suspicion, and advised, though did not urge,

a hysterectomy. The operation, however, was postponed. Four weeks subsequently, the patient returned to the hospital complaining of distress in the vaginal canal. Examination revealed two plum-like growths, one in the anterior and the other in the posterior vaginal wall.

These tumors together with the uterus were removed. On microscopic examination the growths proved to be typical chorionepitheliomas. The patient was operated upon in June of the present year and thus far there is no evidence of recurrent disease.

CASE 3.—Mrs. N. G., aged thirty-five, para vi. The patient was admitted to the hospital with a history precisely similar to that of patient number one, though the hydatid mass primarily expelled was regarded as an abortion. In this patient a large globular mass was found in the anterior vaginal wall. In the uterine body there was a spherical mass, measuring twelve by six by four centimeters. The uterine body together with the vaginal tumor was removed. Microscopic examination showed both the vaginal and uterine growths to be typical chorionepitheliomas. This patient made a good recovery and has not developed recurrent malignant disease.

CASE 4.—Mrs. E. L., aged twenty-six. This patient had a vaginal hysterectomy performed for chorionepithelioma. Recovery. No recurrence.

CASE 5.—Mrs. G. E., aged twenty-five. This patient had an abdominal hysterectomy for chorionepithelioma and recovered. No report of recurrent disease.

CASE 6.—Mrs. L. M., aged thirty-five, para iv. Expelled a large mole. She was curetted twice before admission. An abdominal hysterectomy for chorionepithelioma was performed. The patient died eighteen days later of widespread metastases with pulmonary deposits especially conspicuous.

CASE 7.—Mrs. S. B., aged forty-two, had a dilatation and curettement for a large hydatidiform mole. Death followed from hemorrhage.

CASE 8.—Mrs. M. D., aged thirty-five, had a dilatation and curettement for a hydatidiform mole. No report of recurrent disease. Recovery.

CASE 9.—Mrs. E. P., aged twenty-nine, para ii. This patient had a dilatation and curettement for a hydatidiform mole. Died a few hours subsequently of severe bleeding.

CASE 10.—Mrs. M. U., aged seventeen. This patient had a dilatation and curettement for a hydatidiform mole. Recovery. No report of recurrent disease.

This series of ten cases may convey some idea of the gravity of chorionic villous disease. Six of the patients developed chorionepithelioma. Four recovered and two died. Four of the patients had simple moles. Two recovered and two died.

*(For discussion, see page 437.)*

## A STUDY OF PREGNANCY AND PARTURITION IN PRIMIPARAE WITH BICORNUATE UTERI

BY FREDERICK HOWARD FALLS, M.S., M.D., CHICAGO, ILL.

*(From the Department of Obstetrics and Gynecology, University of Illinois,  
College of Medicine)*

PREGNANCY occurring in bicornuate uteri of more marked degrees, such as the uterus didelphys, uterus duplex, and the uterus with a rudimentary horn has been observed and frequently recorded. Many isolated cases in the literature deal with serious dystocia occurring in those cases.

There is little or no mention, however, of pregnancy and parturition occurring in the milder type of bicornuate uterus, such as the uterus septus, subseptus, and arcuatus. Indeed little attention is paid to these deformities beyond mentioning their existence by the authors of various textbooks. From our observations during the past six years, we feel that anomalies of this type are not uncommon and that they frequently give rise to unwelcome complications, some of which might be avoided completely or their danger minimized if the diagnosis of these deformities were more often made and their significance appreciated.

This study is based on a series of cases observed during the past six years. I would like to call your attention to certain signs and symptoms that seem to be characteristic as well as to show the differences between individual cases and to point out the possible dangers to the mother and fetus inherent in these cases.

The frequency of these deformities is estimated to be about one per cent. I have noted the condition about equally frequent in the white and colored races. No other deformities were noted in these women. Twin pregnancies or other anomalies of development were not especially found in their family histories.

The essential uterine pathology varies with the degree of deformity. Unfortunately it has been difficult to study the essential pathology of the uterine wall and its placental attachment except grossly at operation. We have had one autopsy following a cesarean section, and the bicornuate nature of the uterus was observed.

The essential points seem to be a thinness of the uterine musculature, especially in the lower uterine segment, with rotation and disproportionate enlargement of one or the other horn. Small infarcts of the placenta and a tendency to its anomalous contour (placenta biparte) are frequently seen.

Associated pathologic findings may be upward displacement of the bladder. The bladder was found reaching almost to the umbilicus in two cases. Oblique presentation of the fetus which may be almost



transverse in some cases and intrapartum fetal death from asphyxia may occur. There does not seem to be any tendency to other anomalies of development or deformities in these women as far as I could observe in this small series.

The signs and symptoms presented by patients whose uteri are of this type are characteristic and not difficult to recognize if looked for.

Inspection frequently reveals the uterus deviated to one side of the midline. This is frequently supplemented by the impression of unusual breadth of the fundus of the uterus. In some cases, especially during a Braxton-Hicks contraction, a notch may be seen between the two horns of the uterus. At operation the notch between the horns can be clearly seen after the delivery of the baby.

Percussion corroborates the above findings and may be of considerable help in outlining the uterus, especially in stout women. Auscultation is one of the most important of the diagnostic signs. The fetal heart tones are frequently found to be irregular in rate and strength and may be either too fast or too slow, or what is more common, alternating fast and slow during the count for a period of a minute. Rates of one hundred and sixty and one hundred and seventy even before the patient goes into labor have been noted. Palpation gives, in a woman with thin or moderately thick abdominal walls, the most important diagnostic aid. Often the fundus will be felt to extend from one anterior axillary line to the other. The position of the notch and its depth varies. If one horn is larger than the other, the notch is usually eccentric and shallow; when both horns are of equal size, the notch is usually more pronounced and more central. I have not observed any of these patients in the early weeks of pregnancy. I have under observation at this time a patient who at about six weeks of pregnancy had an angular pregnancy or *grossesse angulaire*. She is now about four months pregnant, and there is some evidence that the uterus may prove to be of bicornuate type. The deviation of the uterus from the midline and its rotation on its longitudinal axis can also be made out. In some cases an oblique presentation due to the displacement of the presenting part into an iliac fossa and the location of the opposite pole of the fetus in the other subcostal region may be made out. This is often spoken of as a transverse presentation and in a primipara is very significant.

Failure of the head to engage at term, and a tendency to premature or postmature delivery is common. In one patient with a complete uterine septum, the impossibility of forcing the head to engage was a marked feature. Postpartum examination revealed a broad fundus in several cases and in one or two a notch could be palpated.

A résumé of the clinical course of labor in these cases is shown in Table I.

Postmaturity, two weeks or more, was noted in four out of the fifteen cases. Only one of this series delivered prematurely at the thirty-fifth week. The average age of these primiparae was twenty-six years, the oldest being thirty eight and the youngest fifteen. Six of the fifteen cases that were allowed to go into labor had a labor of more than seventeen and a half hours, the longest being forty-one, and this was terminated by cesarean section. The average blood loss was estimated to be about five hundred cubic centimeters, which is about twice as much as the average blood loss for a normal case in our clinic. I have felt that this was probably best explained on the basis of a faulty contraction and retraction of the uterine musculature in these cases. Involution was found to be slow in one-half of the cases and normal in the rest.

A study of the babies in this series showed them to be normal in size, weight, and development for the period of gestation. Both babies that died in utero were autopsied, and no cause for the death other than asphyxia could be found. Irregularity of the fetal heart tones in eight out of the fifteen cases was noted. In some of these cases irregularity of the rate was the only deviation from the normal, while in others the fetal heart tones were unusually rapid (180) or unusually slow (100).

Labor terminated spontaneously in six of the fifteen cases. Four cesarean sections were done, two versions and extractions, one breech extraction, and two forceps. Labor was started by bag induction in five cases. The placenta had to be removed manually in two cases. Four of these cases were preeclamptic toxemias. Two mothers died following cesarean section, one had been in labor forty-one hours and the other thirty-six hours when they came to operation. They entered the clinic after several hours of labor and after having had some vaginal examinations which were said to have been carefully done. The autopsy showed infection of the uterus and general peritonitis. Two babies died in utero, one before labor started and one during the first stage, before any dilatation of the cervix had occurred.

Treatment in these cases demands considerable judgment on the part of the obstetrician. The greatest concern during pregnancy should be for the child. Heart tones constantly above one hundred fifty and one hundred sixty should be carefully and frequently observed. If the rate continues rapid and the baby is near term, I believe delivery should be accomplished either by induction of labor or by cesarean section, depending on the degree of irregularity and whether or not labor is complicated by other serious obstetric conditions, such as toxemias or pelvic malformations. The tendency of these patients to go over time should be kept in mind, and labor should be induced before the baby has become too large. In this connection due allowance should be made for the primary uterine inertia which is

TABLE I

NO.	AGE	SENSSES	TERM	LENGTH OF LABOR	TYPE	DIRECTION OF DEVIATION	HEMOR.	INVOLUTION	WEIGHT OF BABY	LENGTH OF BABY	F.H.T	B.P.	RESULTS	REMARKS
1	19	Reg. Mod.	Plus 12	12.5 hr. 3.5 hr. 9 min.	LOA Spon.	$\frac{3}{4}$ Rt.	200	O.K.	3800	52.5	124 178	124 78		
2	15	Reg. Mod.	Plus 4	41 hr.	Ces. sect.	$\frac{3}{4}$ Lt.	450	O.K.	3740	48.5	Irr. 140		M. d	Bladder at umb. Def. notch after de- livery
3	32	Irr. Pain	Plus 15	8 hr. 15 min. 9 min.	LOA Spon.	Rt.	150	O.K.	3315	50	144 160	158 105	B. d	Preeclamptic
4	18	Reg. Pain	0	19 hr. 35 min. 12 min.	LOA Spon.		275		2870	50.5	140	180 90		
5	24	Reg. Prof.	Minus 1	13 $\frac{1}{4}$ hr. 2 $\frac{1}{4}$ hr. 11 min.	LOA Spon.		100	O.K.	3200	49.5	100 164	178 86		Bag induction Preeclamptic
6	37	Reg.	Plus 2	36 hr.	Ces. sect.	Rt.	500		3230	50	Irr. 78	140 78	M. d	Contracted pelvis Bladder high
7	18	Reg. Mod.	Plus 5	16 $\frac{1}{2}$ hr. 52 min. 4 min.	Ext.	Rt.	1500	O.K.	2380	46	Irr. 124 132			Bag induction Breech delivery Manual removal pl.

TABLE I—CONT'D

NO.	AGE	MENSES	TERM	LENGTH OF LABOR	TYPE OF DEVIATION	HEMOR.	INVOLUTION	WEIGHT LENGTH		F.H.T	B.P.	RESULTS	REMARKS
								OF BABY	OF BABY				
8	24	Reg. Mod.	Minus 38	15 45 min.	Ces. sect.	350	Slow	2260	44.5	Reg. 140	112 68		Pyelitis Prem. sep. of plac.
9	21	Irr. Scant	Plus 9	14 10 min.	LOA Spon.	300	Slow			Reg.			
10	31	Reg. Prof.	Plus 17	15 5 hr. 14 min.	LOA Spon.	200	Slow	2625	51	Reg. 140	100 60		Bag induction
11	18	Reg.	0		Forceps	2000		3100	50	156 180			Intra and postpartum hemorrhage
12	37	Reg. Mod.	Minus 4		Vers. ext.	300	Slow	2340		Reg.			Pulmonary Tbe Preeclamptic Bag induction
13	28	Reg. Mod.	Plus 3		Ces. Sect.	250	O.K.	4044	51	Irr. 130 100	110 60		Contracted pelvis Pyelitis
14	38			34 hr. Weak pain	Vers. ext.	800	O.K.	3045		130 160		B. d	Bag induction
15	26	Irr.	Minus 14	30 hr. 1 hr.	Forceps	250	O.K.	2840		Reg. 160			Bag induction Preeclamptic

so commonly seen and which is probably due to the faulty muscular development. Preparations to combat postpartum hemorrhage and for manual removal of the placenta should be made. Because of the frequency of fetal asphyxia, the proper facilities for resuscitation should be provided.

In those cases in which delivery from below is elected, the fetal heart tones should be carefully observed throughout labor, especially in the second stage, and arrangements for operative delivery by version and extraction, breech extraction, and forceps should be made. In those cases in which cesarean section is elected, the high position of the bladder should be remembered and the tendency to torsion and lateral deviation of the uterus should be kept in mind. Cesarean section is more frequently advocated in elderly primiparae showing this deformity, than in women of the same age with normal uteri, because of danger to the child in the primary as well as in subsequent labors.

#### CASE NOTES

The first patient showing this anomaly came under our observation as a private patient in 1920, primipara, thirty-eight years of age, whose menstrual history was without abnormality. She entered Lying-in Hospital one afternoon about 1 P.M., having had weak pains all morning. These pains persisted throughout the afternoon. During the latter months of pregnancy we had noticed that the head was deflected to the left and rested more over the iliac fossa than over the inlet. We also noted that the heart tones were unusually rapid, varying from one hundred and fifty-six to one hundred and sixty-six. This rapidity together with some irregularity following her entry into the hospital was especially noticeable when we tried to force the head over the inlet and into the pelvis. The pains progressed, and the heart tones were present at 6 P.M. Pains were weak, and the patient was making very little progress. The next observation was at 7 P.M.; the heart tones were absent and a definite diagnosis of the death of the baby was made. Labor was allowed to progress the next day and by nine the next morning, since there was practically no advance in spite of weak pains occurring about every ten or fifteen minutes, a Voorhees No. 4 bag was inserted through the cervix. Stronger pains then came on and the bag was expelled about 4 P.M. that afternoon. Following this the pains kept up and the cervix went to nearly complete dilatation; by nine-thirty the patient was showing signs of exhaustion, and there was some evidence of threatened rupture of the uterus. She was, therefore, anesthetized and delivered by version. On introducing the left hand into the uterus, it was found that there was a septum between the examining hand and the baby, though the hand was in the cavity of the uterus. A diagnosis of a bicornuate uterus with septum was made, the septum was perforated, and the baby delivered by version. The patient went into severe shock after the delivery, but rallied and made an uneventful recovery. About a year and a half later I received a letter at the University of Iowa from Dr. DeLee, saying that he had performed a low cervical cesarean section on this patient and had been able to demonstrate at operation the septum which I had penetrated previously.

The second patient of this type was seen at the University of Iowa and presented a ten pound baby with a generally contracted pelvis. The heart tones were noted to be between one hundred and fifty and one hundred and seventy on numerous examinations. There was a deflection of the uterus to the left, so that about seven-eighths of the uterus was to the left of the midline. Because of the size

of the baby and a postmaturity of about two weeks with abnormally, and rapid heart tones, it was felt that the safest method of delivery was cesarean section. At the operation the hypertrophied left horn of the uterus was plainly evident, and the right horn was presented by a slight elevation on the surface of the hypertrophied left horn after the baby was delivered. The round ligament and tube were attached to this small horn.

A third patient was seen at the Cook County Hospital under the following circumstances: The interne on my service reported that he had found a transverse presentation in a primipara with the heart tones one hundred and seventy, and the patient was having strong pains. Having in mind these babies that died in utero, I told him to reserve the operating room for possible cesarean section, and asked him to have an x-ray picture made immediately. I arrived at the hospital just as the patient was placed on the x-ray table for the taking of the picture. Just as the exposure was being made, the membranes ruptured, and the plate was ruined. I listened to the heart tones immediately, and they were not detectable. Without waiting for another picture, we transported her rapidly to the operating room on the floor above. I scrubbed up hurriedly, had the patient rapidly prepared and draped, and did a version and extraction. Following the delivery of the baby I introduced my hand into the uterus and the arcuate nature could be very clearly demonstrated, by inserting the hand into the horns. The baby was resuscitated with some difficulty.

#### CONCLUSIONS

1. Mild degrees of bicornuate uterus (*uterus arcuatus*) are not very uncommon.
2. They tend to produce oblique presentations which in primiparae are presumptive evidence of the deformity.
3. The uterus tends to deviate to one side of the abdomen in many cases.
4. Unusual breadth of the fundus or a notch in its upper surface is frequently seen.
5. Prolonged gestation, and long labor, with weak pains and operative deliveries are often encountered.
6. Postpartum hemorrhage is more common and may be a serious complication.
7. Irregularity of the fetal heart tones during pregnancy and labor is common.
8. Intrauterine fetal death before or in the early part of labor may occur.
9. When the heart tones are constantly irregular in the later weeks of pregnancy, cesarean section should be seriously considered.
10. Subsequent labors should be carefully observed for anomalies of the position of the fetus or the forces of labor.

*(For discussion, see page 440.)*

## THE PROPHYLAXIS OF POSTOPERATIVE PYELITIS

BY WALTER T. DANNREUTHER, M.D., F.A.C.S., NEW YORK

MODERN aseptic technique and expertly administered anesthesia have so reduced the hazards of elective gynecologic operations that the survival of the patient can no longer be accepted as the sole criterion of success. The real test of a pelvic surgeon's skill is an uneventful convalescence, with complete relief of preexisting symptoms. Careful preoperative study and preparation of the patient, particularly with reference to biochemical and functional disorders, have increased the percentage of symptomatic cures and contributed greatly to the lessening of postoperative morbidity. Yet, doubtless, all of us are distressed occasionally by the supervention of some annoying complication during an otherwise normal convalescence. It must be acknowledged that the most important preoperative responsibility of the gynecologist is to gauge the patient's vital resistance correctly. Profiting by experience, we soon realize that much can be done to prevent the mishaps which may arise during the postoperative period. A few cases of parotitis make one recognize the necessity for thorough preliminary inspection of the mouth and teeth, and oral hygiene; two or three cases of thrombophlebitis or pulmonary embolism are sufficient to impress one with the wisdom of encouraging the patient to move her extremities early and frequently after operation; the unexpected precipitation of acidosis or alkalosis in an apparently normal individual suggests the desirability of determining the preoperative values of the more important chemical elements of the blood; and all surgeons now appreciate that anemic and undernourished patients can be protected against the danger of postoperative shock by preliminary blood transfusions. In fact, the veil of obscurity has so lifted from the etiologic factors concerned in the causation of untoward postoperative sequelae that the time will come when the advent of any one of them after an elective gynecologic operation may be justly regarded as a reflection upon the operator's preliminary survey of the patient.

For several years I have made it a practice from time to time to review the results of my own pelvic operations, and in analyzing the five hundred consecutive cases immediately preceding December 31, 1926, I was chagrined to find that acute pyelitis had appeared six times during convalescence. This morbidity of 1.2 per cent is sufficiently high to merit attention, despite the fact that two of the most popular textbooks on the after-treatment of surgical patients fail to mention pyelitis as a postoperative complication. Technically speak-

TABLE I  
SIX CASES OF ACUTE PYELITIS OCCURRING IN 500 CONSECUTIVE PELVIC OPERATIONS  
(PREOPERATIVE DATA)

PATIENT	AGE	PREGNANCIES	URINARY SYMPTOMS	CYSTOSCOPIC EXAMINATION	CONSTIPATION	INDICANURIA	LEUCORRHEA	ENDOCERVICITIS
Case 1 Mrs. V. G.	30	0	0	Negative, including indigocarmine function test	+	+	+	0
Case 2 Mrs. F. P.	45	3	0	Extravesical pressure	+	+	+	+
Case 3 Mrs. M. M.	37	5	0	Negative	+	+	+	+
Case 4 Mrs. S. F.	28	2	Dysuria and frequency for 1 week	Trigonitis (Staphylococcus albus on culture of urine)	+	+	+	0
Case 5 Mrs. F. W.	28	2	0	Not made	+	+	0	0
Case 6 Mrs. R. S.	25	2	0	Negative	+	+	+	+



ing, some degree of pyelonephritis was probably present in these cases because pyelitis is usually secondary to infection of the renal parenchyma.

Although pyelitis occurs frequently in women and its predisposing causes are well known, the reason for its appearance as a postoperative complication at first glance seemed somewhat mysterious. Tabulation of the preoperative data (Table I) concerning the six patients involved disclosed that neither age, parity, nor preexisting urinary disturbances are of special significance. The etiologic importance of intestinal stasis, however, as manifested by constipation and indicanuria, is striking. Notwithstanding that five of the six patients had leucorrhea, only three suffered from endocervicitis, and in each instance the diseased area had been removed at the time of operation. Hence, in all fairness, I do not believe that the renal pelvic infection can be ascribed to a lymphogenous migration of microorganisms from the cervix. Furthermore, it is unlikely that the pyelitis was excited by ureteral reflux, as only one patient had a cystitis before operation. The diversified pathologic conditions and different kinds of operation (Table II) seem to exclude any particular type of pelvic disease as a factor of importance, so it is logical to assume that a long-standing intestinal putrefaction is the chief reason for the occurrence of pyelitis as a postoperative complication.

TABLE II

PATIENT	PATHOLOGIC CONDITION	OPERATION
Case 1 Mrs. V. G.	Chronic recurrent appendicitis Jackson's membrane Right ovarian cyst Retroversion of uterus	Curettage Appendectomy Oophorocystectomy Round ligament shortening
Case 2 Mrs. F. P.	Lacerated cervix Rectocele Parovarian cyst Left broad ligament hematoma Retroflexion of uterus	Tracheloplasty Perineorrhaphy Cystectomy Resection of broad ligament Round ligament shortening
Case 3 Mrs. M. M.	Lacerated cervix Ectopic gestation (right) Chronic salpingitis (left)	Tracheloplasty Salpingo-oophorectomy Appendectomy
Case 4 Mrs. S. F.	Bilateral tuboovarian abscess	Salpingo-oophorectomy
Case 5 Mrs. F. W.	Chronic metritis Bilateral salpingo-oophoritis Cystic ovaries	Supravaginal hysterectomy
Case 6 Mrs. R. S.	Lacerated cervix Rectocele Left parovarian cyst Retroversion of uterus	Tracheloplasty Perineorrhaphy Salpingo-oophorocystectomy Round ligament shortening Appendectomy

TABLE III  
MANIFESTATIONS OF ACUTE POSTOPERATIVE PYELITIS

PATIENT	DAY OF ONSET	CHILL	TEMPERATURE	PULSE	NAUSEA	LUMBAR PAIN	HEADACHE	URINE CULTURE	ASSOCIATED CYSTITIS
Case 1 Mrs. V. G.	10	+	104.6	90	0	+	+	Colon bacilli	0
Case 2 Mrs. F. P.	18	+	103	88	+	0	0	Colon bacilli	0
Case 3 Mrs. M. M.	16	0	102.4	100	0	0	+	Colon bacilli	0
Case 4 Mrs. S. F.	14	0	102.2	100	+	+	0	Colon bacilli	0
Case 5 Mrs. F. W.	10	0	101.6	116	+	+	0	Colon bacilli	+
Case 6 Mrs. R. S.	10	0	100.6	86	+	+	+	Colon bacilli	0

Analyzing Table III, the following conclusions seem justified: acute pyelitis is likely to occur as a postoperative complication between the tenth and eighteenth days; the onset is usually sudden and is manifested by pyrexia, nausea, lumbar pain, and headache, although all these symptoms may not be present in any one case; the pulse may be rapid, but does not parallel the rise in temperature; patients with a high fever may have an initial chill, and the colon bacillus will almost invariably be discovered in the urine. In view of the fact that the clinical picture is not always the same, it is possible that some of these cases may pass unrecognized. The diagnosis is easily made by examining the urine microscopically and bacteriologically. Colon bacilli were found in the specimens from each of my six patients. The treatment consisted of daily colonic irrigations, forced fluids, hexamethylenamine and acid sodium phosphate, and a few irrigations of the affected renal pelvis with silver nitrate after the acute symptoms had subsided. Prompt recovery followed.

Indican, or indoxyl potassium sulphate, is derived from indol, a product of intestinal putrefaction of albuminous substances. The indol is absorbed by the blood and oxidized in the tissues to indoxyl, which combines with potassium sulphate and is eliminated in the urine (Heitzmann). Small quantities of indican are present in normal urine, but since ethereal sulphates are products of decomposition, the intensity of an indicanuria varies in direct proportion to the amount of albuminous putrefaction in the small intestine. On these premises the occurrence of postoperative pyelitis can be justly attributed to a hematogenous colon bacillus infection, arising from an intestine harboring putrefying contents.

The corollary of this implies thorough intestinal cleansing and elimination of decomposing material before operation in all patients having excessive amounts of indican in the urine. Since reviewing the group of cases referred to, I have made it a practice to defer operation for at least two weeks in such patients, prescribing daily high colonic irrigations, *Bacillus acidophilus* cultures, large doses of mineral oil, a diet free from fats and sugars, forced fluids, and full doses of hexamethylenamine and sodium benzoate. Theoretically, hexylresorcinol would seem to be the ideal agent to protect the upper urinary tract from bacterial invasion, but the incidental necessity for restricting the ingestion of fluids to reduce the surface tension of the urine is a serious disadvantage in prospective operative patients.

#### CONCLUSIONS

1. Acute pyelitis occurred in six instances during convalescence in a series of five hundred consecutive patients subjected to pelvic operations; a morbidity of 1.2 per cent.

2. All six patients suffered from obstinate constipation and a pronounced indicanuria before operation.

3. An inexplicable rise of temperature between the tenth and eighteenth postoperative day, accompanied by nausea, lumbar pain, or headache should arouse suspicion of an acute pyelitis.

4. Colon bacilli will almost invariably be found in the urine.

5. Thorough preoperative intestinal cleansing and elimination of decomposing material, together with the administration of hexamethylenamine are efficient prophylactic measures.

580 PARK AVENUE.

*(For discussion, see page 448)*

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## THE VOMITING OF PREGNANCY

BY EDWARD SPEIDEL, M.D., F.A.C.S., LOUISVILLE, KY.

THE incidence and mortality of eclampsia has been reduced enormously in localities and institutions where patients receive proper prenatal care. This is due to the fact that as soon as there is a rise in blood pressure and an albuminuria, strenuous efforts are made at once to combat these preeclamptic symptoms and ward off a possible eclampsia.

Unfortunately, the same zeal is not shown with the early toxemia of pregnancy. In spite of the fact that nausea and vomiting are always the forerunners of the more serious condition, hyperemesis, it receives scant or no attention.

From personal observation and the many articles in the literature of late, hyperemesis is now a more frequent condition than eclampsia. When we read the contributions of Titus on over 328 cases and of Harding on 200 cases, all serious enough to require the intravenous use of glucose, they report upon more patients with this condition than they would be able to present upon as preventable a disease as eclampsia.

As to the comparative seriousness of the two conditions, through recent improvements in therapy, eclampsia has lost a great deal of its terror with a distinctly lessened mortality. It is unfortunate, then, that by comparison no mortality statistics are available on hyperemesis gravidarum. An inquiry addressed to the Department of Vital Statistics received the following reply: "The data requested in your letter are not separately compiled in the Bureau of the Census, hyperemesis being included under international title 143 C (Accidents of Pregnancy). Abortion following vomiting of pregnancy is assigned to 143 A. Nephritis of pregnancy and vomiting of pregnancy are assigned to 148 C."

It is well known that deaths from hyperemesis are not reported directly as such. If they were, it would soon be evident to all of us that the condition causes as great a loss of life as eclampsia.

Even if it can be proved that the mortality from hyperemesis is negligible as compared to eclampsia, it still deserves consideration, because the distress and morbidity are greater than in eclampsia. In eclampsia there is a sudden onset with more or less unconsciousness and recovery or death generally within twenty-four to forty-eight hours. In hyperemesis, weeks and weeks of comparatively slight discomfort culminate in days of extreme distress accompanied by constant vomiting and even the inability to retain water. Any one who has ever passed through a severe attack of seasickness can appreciate the plight of the woman with hyperemesis, and it must be conceded that the condition is largely preventable. In many years of practice I remember no cases that originated among my own patients. Experience was only gained from consultation and referred cases. Upon inquiry the same holds good with other members of our obstetric staff. Only a few such cases have developed in our prenatal clinic since its organization. This no doubt is the experience of obstetricians and large institutions elsewhere, such cases coming to them for consultation or treatment in the final stages, with conclusive evidence of little or no care or attention in the early stage.

There is a very good reason for this. It is unfortunate for the pregnant woman that nausea and vomiting is classed as one of the presumptive signs of pregnancy. The physician recognizes it gladly as an additional aid in the absence of only one menstrual period, to an early diagnosis of pregnancy. To older women always on the alert in watching the newly married, it is the earliest telltale evidence of the condition which the new bride is so anxious to conceal. It is treated with a great deal of levity and is generally regarded as a necessary evil in such circumstances, so that little sympathy or comfort can be expected, until the condition becomes serious. The physician, with the understanding that the symptom occurs in 60 per cent of primiparas, is likely to be equally callous unless the situation becomes grave, yet it is in this early stage that treatment must be instituted to forestall a possible hyperemesis.

Of the many explanations for the condition, the rhythmical contractions of the uterus incited by the pregnancy may readily be responsible for the reflex irritation of the gastrointestinal tract that results in nausea and vomiting; a toxemia due to the presence of the fetus will naturally increase the irritability of the expanding uterus.

It must be realized that with the onset of pregnancy the uterus, a comparatively inactive organ, enters upon a state of intense metabolism. The intermittent muscular contractions that are at once instituted and that are later on recognized as Braxton Hicks' contrac-

tions control the circulation in the placental sinuses and cause a constant exchange of maternal and fetal products. One of the functions of the placenta is to store glycogen for the growing fetus until the fetal liver is able to store its own reserve carbohydrate, and during this period it is the glycogen of the maternal liver upon which it draws for its supply. At the end of the third month the fetal liver is fully formed and able to store its own glycogen, and then in ordinary circumstances the drain on the maternal liver should cease.

According to Harding this drain on the glycogen content of the maternal liver occurs with the very onset of pregnancy and the early nausea and vomiting is an indication of the resulting deficiency in that organ. The continued and increased demand for glycogen on the part of the rapidly growing fetus drains the glycogen content of the maternal liver; this deficiency causes nausea and vomiting, and the vomiting results in inanition and starvation with fatty infiltration and degeneration of the liver cells and ketonuria.

The sudden cessation of vomiting in many cases at about the third month of gestation is claimed to be due to the fact that the fetal liver has reached full development, and by storing its own glycogen relieves the maternal liver of the drain that is responsible for the vomiting. The neurotic element is explained as follows: Harding again states that a normal pregnancy is marked by heightened nerve reflexes. An unduly sensitive, sympathetic nervous system will result in the diminution of glycogen in the liver, because excitation of that system produces an excess of sugar in the blood at the expense of the glycogen in the liver; this naturally will be followed by nausea and vomiting. If the condition is largely neurotic, then suggestive therapeutics should control the vomiting. This will explain the sudden cessation of vomiting when the patient is removed to a hospital, away from the husband and the overly anxious members of her family.

The public is already educated up to the fact that albumin in the urine of the pregnant woman will lead to convulsions; they should now be taught that the early vomiting of pregnancy is a sign of equal gravity and that by treatment of that apparently simple condition the onset of the serious condition of hyperemesis can be largely prevented. Primiparae can be taught to put themselves in charge of their physician as soon as pregnancy is suspected and multiparae as soon as vomiting shows itself in pregnancy.

It is possible in all circumstances at least to make the patient more comfortable. The first essential for success is the prohibition of coitus. If the patient can sleep alone and even have a separate room, conditions are at once considerably improved. The woman should rest as much as possible, lying in bed longer in the morning when the nausea is generally aggravated. She should be relieved as much as possible from the duties of cooking. It is manifestly absurd to expect to relieve a woman of nausea and vomiting when she has to

prepare three meals a day. Even in the poorest families it will generally be possible to get the husband to prepare his own breakfast or get it elsewhere and add that much to bettering such a situation.

The old advice to send the young bride home on a visit to her mother has much to commend it. It undoubtedly eliminated the nostalgia which could readily be a factor with the young girl just torn from her home surroundings and suddenly initiated into the mysterious experiences of the marital state. It removed her from the embraces of the husband and the household duties incumbent upon her marriage. In such isolation there should be an immediate improvement, or the condition should respond readily to treatment. As to actual treatment, with proper arrangements made in her surroundings, the ordinary regulations of hygiene being observed, medication largely suggestive should relieve the condition. The intravenous administration of an ampoule of extract of corpus luteum daily seems to have a happy effect in this early stage, especially if the patient is compelled to come to the physician's office for its administration.

A one and a half grain dose of luminal-sodium three times daily, in addition, will have a tendency to allay the neurotic feature of the case and provide much needed rest.

In some instances the additional administration of ten drops of dilute hydrochloric acid in water before meals is necessary before success becomes assured. It is claimed that there is an hypochlorhydria in pregnancy conducive to nausea and that the administration of the dilute hydrochloric acid corrects that condition and should relieve the distress. If a laxative becomes necessary, tablespoon doses of milk of magnesia at bedtime will generally be effective and will alleviate the existing pyrosis. This with an enema of one-half gallon of warm water containing a tablespoonful of bicarbonate of soda, will empty the lower bowel and will to some extent relieve the acidosis. The feeding of patients in this early stage requires a little more thought and consideration than is generally given to it. Full meals are rarely desirable. Graham wafers, Holland rusks eaten dry are good foods to begin with. A dainty sandwich brought to the patient on a plate, lemonade, iced tea, and a few teaspoonfuls of pineapple juice in sweetened ice water will often tempt the patient and be retained. Salted pop corn will stay when nothing else can be retained and the dry cereals, puffed rice, corn flakes, etc., are in the same class. Peptonized foods are no longer administered per rectum as there is so little absorbed by that route, and the rectum soon becomes irritable and rejects it. More can be accomplished by reserving the rectal route for the absorption of needed sedative medication later on. It is always important, of course, to examine for any uterine abnormality, and if a retroversion is discovered, it should not only be corrected, but a supporting pessary should be inserted to keep the uterus

in its corrected position, the presence of the pessary also having a physic effect in relieving the condition.

Copeman's treatment of nausea and vomiting by finger or instrumental dilatation of the cervix has been recommended since time immemorial and is still practiced as evidenced by a case referred to me only recently. As early as 1884 Gill-Wylie warned against the procedure, unless it was conducted with antiseptic precautions, and he published the following directions: "After careful disinfection of the vulva and vagina with bichloride solution, the blades of the metal dilator dipped in pure carbolic acid, should be introduced into the cervix for about 1½ inches and slow dilatation practiced, followed by the application of glycerin gauze to the cervix." It is evident that with our advance in surgical technic even more care should be practiced, since interruption of the pregnancy may follow in consequence of the manipulations, and a serious infection result from a lack of such precautions. In a case recently referred to me a pyemic infection was inflicted upon a patient already in a low state of vitality from two weeks of incessant vomiting. In a primitive way relief from thirst and hunger in the graver cases can always be given to these patients, even in the poorest surroundings, by the gentle introduction into the rectum, with the patient lying on the left side, of four to eight ounces of water warmed to body temperature and containing two tablespoonfuls of honey or Karo syrup to the pint—an effective substitute for the glucose injections used in cases of hyperemesis.

When the condition does not yield to these simple measures, then nausea and vomiting takes on the aspect of hyperemesis, and extreme measures should be delayed no longer. There are certain well-defined and tried procedures in the treatment of this distressing condition that can safely be carried out even in the home, and these should be instituted without delay. Isolation in a hospital is, of course, most desirable, but if that cannot be secured, then conditions should be as closely simulated as possible in the private home, by removal of the patient to the brightest and sunniest room in the house and as far away from the kitchen as possible. The anxious husband and family and visitors should be excluded. The patient should be kept in a somnolent condition by the rectal introduction of 6 ounces of 10 per cent glucose solution, containing 60 grains of sodium bromide and 15 grains of chloral hydrate, three times a day more or less, to secure the desired result. One quart of decinormal saline solution should be instilled under the breasts daily to correct the dehydration and 500 c.c. of warmed 10 per cent glucose solution should be given intravenously daily until the vomiting is checked. No water or food or medication should be administered by mouth until this is accomplished. With the ingredients for normal saline solution put up in ampoules and 50



per cent solutions of glucose available in glass containers for dilution with fresh distilled water, such therapeutic procedures should be possible anywhere.

It is hardly justifiable, in view of the general advance in medical knowledge even by the laity, that extreme cases of hyperemesis with sordes on the teeth, dry red tongue, cracked lips, and bloody vomit should come to treatment. It should be classed as criminal if a pregnant woman is neglected to such an extent.

It is in extremely toxic cases, however, that therapeutic refinements must be added to the regular treatment to effect a cure. A hypodermic of pantopon with an ampoule of scopolamin is at times necessary in the initial treatment of hyperemesis to give the patient a temporary respite from the incessant retching. This combination will be found more agreeable than the morphine usually injected.

Glucose again, of course, is our sheet anchor in these grave cases, and it is fortunate that various avenues of administration are available. Oral administration is out of the question in this condition, and subdermal introduction is rather painful even with a little novocaine added to the solution. Fortunately the duodenal route can be used, and with the introduction of the tube sometimes preceded by spraying the throat with cocaine, glucose solution in definite amounts can be readily introduced into the system. The tube can be passed through the nose, if it is the intention to leave it in place a considerable time, and then water, glucose solution, other liquid foods, and even laxatives can be successfully introduced into the system.

The intravenous introduction of glucose solution is receiving most attention at present. Hendon presents an ingenious arrangement for the continuous administration of glucose solution—intravenous nutrition as he calls it. The median basilic vein is dissected up for about an inch and a half, and a specially devised blunt cannula with an obturator is introduced and tied into the vein beyond the first shoulder. The skin incision is then closed beyond the second shoulder, securing the apparatus safely in place. The glucose solution heated to proper temperature is put into a vacuum flask. Rubber tubing with a glass bulb arrangement for regulating the flow of the solution to the required number of drops per minute is connected with the tube; then at the lower end a glass nozzle with six inches of catheter tube connects with the cannula in the vein. The patient's arm is bandaged to a padded splint to prevent movement, especially flexion, and the glucose solution is allowed to flow. It can readily be estimated that with a flow of 20 drops a minute sixty fluid ounces of the solution can be introduced in twenty-four hours, and the apparatus has been kept going in one reported case for eight days. Hendon uses a 5 per cent solution but stronger solutions can, of course, be administered.

The intravenous administration of sodium bicarbonate with glucose is advocated by Wilson on the ground that hyperemesis is due to a disturbance of the carbohydrate metabolism. The ordinary percentage of carbon dioxide combining power or alkali reserve is 53 to 70. In pregnancy it will generally be found low, from 50 to 55 per cent. In consequence, the least disturbance of this slight balance will cause an acidosis.

As acidosis is caused by the abnormal formation of acid substances or the deficient elimination of acid substances normally found in the blood, the percentage estimate of the carbon dioxide combining power or the alkali reserve should give a desirable estimate of the individual metabolism.

A low carbon dioxide combining power of the blood is present in all cases of hyperemesis, and the percentage estimate should serve as an index of the severity of the condition. With an elevation of this index from its low level to normal or higher and a consequent relief of the existing acidosis by the glucose bicarbonate therapy, there should be a decided improvement in the condition. Continued treatment can then be rationally based upon the percentage estimate of the alkali reserve. Glucose will elevate the alkali reserve, but it can be raised more rapidly if sodium bicarbonate is given with it. Consequently, Wilson advocates the intravenous administration of 200 c.c. of 10 per cent glucose with 200 c.c. of 3 per cent sodium bicarbonate as the initial dose. The initial injection may be given upon the assumption that an acidosis is present in serious cases, but a second injection should not be given until the carbonate dioxide combining power is determined, in order to avoid an alkalosis. The solutions should be prepared and sterilized separately, heated to body temperature, and mixed. If heated together caramelization of some of the glucose may take place and render the solution unfit for use. There seems to be a rational basis for this treatment, and it should be given due consideration.

There is considerable controversy at present as to the intravenous administration of glucose with or without insulin in the treatment of this condition. Titus claims that the glucose infusion not only corrects the existing carbohydrate deficiency but restores the liver cells which have been destroyed by the toxemia and that the addition of insulin causes glycogen stores to become depleted by its demand for glucose to be oxidized and otherwise metabolized. In toxemia of pregnancy, therefore, in which storage in the liver and not combustion of the injected sugar is the desired result, the simultaneous administration of insulin is contraindicated. Titus admits, however, that insulin is indicated when the acidosis is so great that the patient is in coma.

Thalhimer claims that the rapid eradication of ketonuria and even of acidosis by combining insulin and glucose therapy seems to cause

relief of the nausea and vomiting in these nondiabetic patients. He claims that the use of insulin considerably shortens the treatment, as the vomiting ceases with the absence of ketonuria. As to any danger from the use of insulin in such cases, it is claimed that the amount used, that is, one unit of insulin for every three grams of glucose, can cause only sufficient carbohydrate utilization to hasten the disappearance of the acidosis. It would take much larger doses of insulin to cause loss of glycogen from the liver. Given as directed, the small amount of insulin cannot possibly prove an element of danger, as larger amounts are being given to nondiabetic children. Barbour reports the administration of insulin to forty nondiabetic malnourished children. One child, nine years of age, received 15 units daily for fifty-one days. With this point in dispute eliminated, the question then resolves itself into which is most desirable in the therapy of hyperemesis, storage of glycogen in the liver as advocated by Titus or rapid combustion of carbohydrates with insulin as advocated by Thalhimer. Thalhimer advocates the use of 1000 c.c. of 10 per cent or 2000 c.c. of 5 per cent glucose in very dehydrated patients, administered over a period of from four to five hours.

It may well be claimed that the intravenous administration of so large a volume of fluid will at times cause some cardiac embarrassment and requires the constant personal attendance of the physician during this entire period.

I had a patient complain of cardiac distress recently after only 150 c.c. of glucose solution had been introduced. The needle was at once withdrawn, and 500 c.c. of the solution were introduced the next day without discomfort.

In recent literature Clark reports two sudden deaths from acute dilatation of the heart, following intravenous introduction of 500 c.c. of properly prepared glucose solution.

Again, some patients show a considerable reaction followed by an elevation of temperature upon the introduction of the glucose solution. The solutions should always be prepared with pure glucose and freshly distilled water, and administered at body temperature. Various devices may be used to keep the solution at proper temperature during its administration. The solution properly warmed can be drawn from a vacuum bottle, an electric heating pad set at low can be fastened to the glass container holding the glucose solution, or the lower part of the tubing can lie on a hot water bag.

The strength of the glucose solution to be injected is another point of dispute. As just mentioned, Thalhimer advocates a 5 or 10 per cent solution; Titus, on the other hand, claims that 25 per cent solutions act more promptly and favorably than weaker solutions.

Wilder and Sansum have demonstrated that the average individual has a glucose saturation point, determined by the elimination of glu-

glucose in the urine, after definite amounts have been administered intravenously. This saturation point has been placed at 0.85 grams per kilogram hour for the average person. Taking the average woman in the early months of pregnancy at 130 pounds, that would amount to about 50 grams of glucose per hour for such a patient. In other words it should take two hours to introduce 1000 c.c. of a 10 per cent solution of glucose intravenously into such a patient. They also demonstrated that a 16 to 18 per cent solution is the most desirable one for introduction.

In our own hospital investigations with the intravenous injection of glucose solutions of various strength, it was demonstrated that glucose was invariably present in the urine if a solution stronger than 15 per cent was used.

Again, it has been found that when the normal tolerance of 0.85 grams per kilogram hour is exceeded either by too rapid introduction or by the instillation of too concentrated a solution, that unconsumed glucose at once appears in the urine and a profuse diuresis results. As dehydration is such an evident feature of serious cases of hyperemesis, it can be realized at once that diuresis is not desirable at the onset of treatment. Exactly the opposite condition prevails when glucose is injected in eclampsia. The coma in that condition is admittedly due to cerebral edema and with the intravenous introduction of strong solutions, even up to 50 per cent, a profuse diuresis results with absorption of this edema and a return of consciousness. Again, it is evident that the degenerative changes that occur in the maternal liver in hyperemesis also affect other organs, especially the heart, and that it is dangerous in consequence to subject such patients to the risk of a severe reaction or to cardiac distress following the introduction of large quantities of fluid into the veins in a short time.

In extreme cases not responding readily to the glucose injections, therapy by means of the duodenal tube will be found effective.

In a recent case, a primipara, thirty-eight years of age, with the first conception after fifteen years of marriage, the duodenal tube was introduced and kept in place for five days. After draining the gall bladder, water, food, and medication were introduced through the tube and retained, and when the tube was removed, oral feeding could be resumed, and the patient carried the pregnancy safely to the end.

Polak advocates the transfusion of 300 c.c. of human blood by the direct method with 500 c.c. of physiologic sodium chloride solution added. It is well to remember this therapeutic measure, in severe cases that do not readily respond to the ordinary treatment and especially where for religious reasons an interruption of the pregnancy will not be permitted.

Let us not delude ourselves, however, that all cases of hyperemesis can be relieved by injections of glucose. Every now and then in a

serious case a patient that has ceased vomiting and is apparently taking an abundance of food will begin to show choreic symptoms and signs of polyneuritis. In such cases even the prompt evacuation of the uterus seems to be of no avail, as happened in a recent case in which that extreme expedient had to be used after the patient was apparently well over her vomiting and was taking an abundance of food.

Accordingly, it is suggested that severe cases of hyperemesis be subjected to intensive glucose therapy for four days. If marked improvement does not result then duodenal treatment should be added for four days. If at the end of that time decided improvement is not evident, then interruption of the pregnancy should be justifiable.

#### CONCLUSIONS

1. The next logical step in the reduction of maternal mortality and morbidity is in the prevention of hyperemesis.

2. Just as eclampsia has been largely eliminated by intensive treatment of the preeclamptic state, so by the prompt treatment of the ordinary vomiting of pregnancy, hyperemesis can be prevented.

3. The successful treatment of hyperemesis depends upon: absolute isolation of the patient from husband and family, which alone will often check the condition. Nerve sedatives, such as sodium bromide and chloral, per rectum. Dehydration combated by submammary introduction of decinormal saline solution. Inanition and acidosis counteracted by glucose intravenously. Interruption of the pregnancy if no prompt improvement and especially if choreic symptoms manifest themselves.

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(For discussion, see page 442.)

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## THE TREATMENT OF VAGINISMUS

BY FRANCIS REDER, M.D., ST. LOUIS, MO.

**R**EMEMBERING that vaginismus is sometimes an idiopathic, but generally a symptomatic disorder, the principal effort should be directed toward ascertaining the causal condition. This may require much care and tact on the part of the physician, and unless he can arrive at some definite conclusion as to the cause of the spastic manifestation, treatment can be only empiric and most likely of little avail.

The term "vaginismus" has been greatly abused and has served conveniently to characterize many of the conditions associated with pain about the orifice of the vulva. Vaginismus is an affection recognized by more or less active involuntary local sphincteric resistance at the ostium vaginae to penetration. There is an associated pain

which may be slight or severe. Diagnosis should offer no difficulty if note be taken of the spasmodic contraction at the introitus. It is here that ignorance or an insufficient examination is often culpable. Pain or discomfort caused by coitus, no matter how severe, cannot be designated as vaginismus. The term dyspareunia has been given to this condition, meaning difficult or painful performance of the sexual act. In this affection intromission is possible, whereas in a frank vaginismus it is not.

The great difficulty encountered in vaginismus is to ascertain the nature of the reflex spasm and, inasmuch as the condition can be idiopathic or symptomatic, the solving of this problem may prove perplexing.

The idiopathic type of vaginismus is a most unfortunate condition and is due to an excessive nervous irritability, usually affecting the whole system. It has been designated a hysterical anxiety neurosis, not a neurosis based on either peripheral or central irritation. These patients unconsciously develop the psychogenetic paroxysm and in the majority of cases present the picture of a real hysteria. As long as the irritable condition of the psychomotor areas of the sex organs persists, nothing of an encouraging nature as to a cure of the existing vaginismus can be expected. The treatment of this type of vaginismus is a question for the patient herself; it is usually incurable.

In vaginismus of the symptomatic type we have a condition of a more encouraging nature. Here the primary underlying cause is usually some local anomaly. It may be an apparently insignificant local disorder, or it may be a condition sufficiently serious to produce much suffering. When a healthy woman with common sense complains that intercourse hurts her so that she cannot submit to it, the physician may at once make up his mind that there is some definite cause for her condition.

By far the most common causes of the patient's sufferings in these cases are fissures resulting from marital rents, or too frequent intercourse, resulting in excoriations of the nymphae, or chronic vulvitis. Furthermore, a tender myrtiform caruncle, an irritable hymen, a urethral caruncle, an anal fissure, or a vascular degeneration of the mucous membrane, usually on the inner surfaces of the nymphae, may prove to be the cause of the total suspension of marital intercourse.

These are the pathologic lesions responsible for this distressing condition, and upon their prompt recognition depends the future happiness of the parties interested. It is by no means an easy task to discover the exciting cause, during the first consultation, even upon a most thorough examination and close inspection, and a subsequent examination under anesthesia may become necessary. However, it is

advisable that the patient should first be examined without an anesthetic in order that the spastic condition about the introitus may be appreciated.

Additional reference is apropos to those cases of vaginismus not infrequently witnessed in the newly married. Although there is no ascertainable pathologic lesion about the ostium vaginae, a spastic condition of the parts is invariably produced when coitus is attempted. Upon what basis can this condition be explained? Usually the individual is of an emotional nature with the neuropsychic tendency predominating. She has read much and has heard more of the pain connected with defloration, which created in her the mental picture of fear, the most widely distributed of the emotions and the most powerful in its effect upon the organism. Harassed by this psychic trauma, it is only reasonable to assume that the fear of coitus, rather than the pain of contact, is the causative factor.

In an individual with a fairly stable neural balance, when a proper understanding as to the performance of the sexual act has been reached by both parties, the condition may disappear in a short time, either naturally or by the aid of simple measures. For these cases an extremely tactful and delicate consideration by the consultant, whenever his opinion is sought, will prove to be the most efficacious therapy.

In the more obstinate cases where there appears to be a somewhat pronounced neuropsychic personality, improvement may be accomplished by wisely chosen catharsis and by hydrotherapy. Opening the emunctories seems to open up mental paths favorable to a cure.

What is the prognosis of this affection? In those cases of vaginismus classed as idiopathic, where the individual is obsessed with a strong psychoneurologic element, the prognosis is not encouraging. The affection may remain indefinitely, becoming a permanent source of discomfort and woe. In those cases where the neural balance shows little deviation from the normal, and where the disturbance in the synaptic relations and in the cell chromatolysis has been slight, the outlook for a cure is very encouraging. The cases of vaginismus dependent upon anatomic causes, where a demonstrable lesion can be identified as the offending pathology, constitute the most favorable group for a cure. It is in this class of cases that a surgical measure is often deemed advisable to remedy the condition.

Usually every case of vaginismus is subjected to a course of treatment. This is as it should be. It may be possible that the application of a simple cerate, together with dilatation of the introitus, will relieve the condition. Again, the correction of any pathology present, such as fissure, vaginal or anal, the removal of a urethral caruncle, the incision of a resistant hymen, or the excision of oversensi-

tive carunculae myrtiformes, at the same time thoroughly stretching the vaginal opening, may prove of great benefit to the patient and eventually result in a cure.

There are, however, severe and obstinate forms of this affection that are not much benefited by the foregoing procedures. The spasmodic contraction and the hyperesthetic condition of the vulvar orifice still renders the patient wholly unfit for her sexual functions. For the relief of this condition it becomes imperative to resort to an expedient that resolves itself into a surgical measure, the object of which is twofold, that of severing some of the fibers of the muscles directly implicated in the reflex spasm, and the enlarging of the vulval outlet. In performing this operation, an open procedure and not a subcutaneous one, should be given preference.

There are two methods that are successfully practiced. In the one an incision is made in the median line at the posterior part of the vaginal orifice. This incision should pass three-fourths of an inch into the perineum and extend one inch up the vagina. The cut muscle should be allowed to gape, while the mucous membrane is dissected free for a short distance on either side of the wound and sewed across the gap. In the other, two lateral incisions on either side of the fourchette converging in the median line just above the sphincter ani to form a V are made. These incisions pass through the edges of the constrictor cunni, and when carried deep enough also sever some of the fibers of the anterior layer of the levator ani. The wound is closed in a manner that will insure an enlarged vulval outlet. It is advisable to use a nonabsorbable suture material. As soon as the postoperative condition permits the introduction of a Sim's glass vaginal dilator, it should be worn by the patient for two hours morning and evening for several weeks.

Of the two methods, my preference is for the lateral incisions. Patients suffering with vaginismus are very irritable and become quickly dissatisfied if the expected cure does not follow the operation within reasonable time.

When should these stubborn cases be subjected to operation? No definite rule can govern the time; however, it can be assumed, and this assumption can be justly acted upon, when after four to six months of proper treatment no appreciable improvement in the condition has evidenced itself, and the patient no longer makes an effort to conceal her dissatisfaction, it is my opinion that the time for operation has arrived.

UNIVERSITY CLUB BUILDING.

(For discussion, see page 484.)



## MODERN OBSTETRICS IN THE HOME

By JAMES R. BLOSS, M.D., HUNTINGTON, W. VA.

THE invitation of your Secretary to present a paper before this honored Society brings me to the conclusion, that a plain practical paper would not be amiss, that it might bring forth a desired discussion of our everyday problems. My obstetric work is largely carried out in the homes of my patients, as is the custom in our section at the present time. Since one cannot change the scheme of things at will, I have made an honest effort to give to my clientele good care and conscientious service. It has constantly been my desire to improve the technic of obstetrics in home delivery that I might rob it of such dangers as may be possible.

It is not necessary to dwell upon statistics relating to morbidity or mortality among parturient women before this Association. Members of this body have been leaders in bringing these figures so forcibly to the attention of our profession. You deserve commendation for your efforts along this line, yet many questions are continually in one's mind as to the possibility of further reducing the number of fatalities and the morbidity in this particular field of work.

We must estimate the situation correctly. We must admit that at the present time by far the greater number of deliveries occur in the homes, and it will continue to be so for many years. That very desirable obstetric millennium when all pregnant women will go to our hospitals for confinement is in the dim and far distant future. If all were cared for in the aseptic delivery rooms of our hospitals by obstetricians, then the statistics would not be so disheartening.

The economic side must be considered, however, for not all patients are able to afford hospitalization unless they are to accept charity either from the hospital or from the physician. My personal experience is that by far the greater number of patients in moderate financial circumstances desire to pay for services rendered and prefer to remain at home and pay the physician for his care.

With the conditions as they are at present, it would seem that the wise thing to do is to study ways and means by which we may carry a better obstetric service to the very firing line, as it were. I speak feelingly of these things, for my work is done in one of the smaller cities of the country. Obstetric practice was not very highly regarded in this section until the past twelve or fifteen years. It was placed in the same category with anesthesia. Any physician and many of the neighbor-women were regarded as being thoroughly competent to render the service required. It is feared that too many physicians still regard this field of work in the same light. At the present time midwives do but very little work in this locality. Only two in fact

are so registered. Probably too many of our profession fail to appreciate the great advance of asepsis, even as applied to obstetric practice. Observation leads one to this conclusion in many instances.

Just here it is not amiss to mention a problem which, in my opinion, has a very great bearing upon the unfavorable statistical situation. The fact that we have established the value of asepsis and antisepsis leads to the performance of too many obstetric operations to hasten delivery that a little time may be saved. There are too many forceps deliveries; too many versions. Each has its particular place, it is true, but frequently they are injudiciously undertaken simply because it is felt that they are safe if one uses antiseptics. Many infants are sacrificed needlessly, and antiseptics do not always prevent infection. Additions to the therapeutic armamentarium of the obstetrician are not always free from danger in this same connection. The prevalent indiscriminate use of pituitrin falls in the same classification. When indicated and used judiciously in proper dosage, it is an agent of great value, yet untold injury has been done to mothers and infants with it. The performance of cesarean sections has become almost an epidemic. No reason can be offered to excuse this injudicious and pernicious rushing of so great a number of parturient women to the operating table. This widespread prevalence of needless obstetric surgery can only be emphatically condemned.

Every effort is made to give each patient thorough prenatal care. It has been and still is difficult to get women to appreciate the importance of this and to place themselves under the care of a physician at once after the passing of a menstrual period, that they may have an examination and be given careful advice. Gradually this is being overcome. The results cause patients to tell it to their friends, and they are encouraged to go to their own physicians under similar conditions. In this way prenatal care is being given more consideration, not only by the patients but by the physicians as well.

It does not prove to be a too difficult or time-consuming thing to make a thorough examination of our patient's general physical condition. First, is secured, as completely as is possible, a history—personal and family. The physical examination is carefully made, and always is included pelvimetry, external and internal, and an examination of the pelvic contents. Blood-pressure readings and urinalyses are made; a routine Wassermann test is made, and weight is recorded. It is insisted upon that the patient be seen every two weeks until the sixth week before estimated delivery and each week thereafter. At these visits blood-pressure readings are taken, and a urinalysis is made. General advice is given as to diet, exercise, and so on. Two to four weeks before confinement a list of articles to be sterilized is given to the patient. These articles are then brought to the office where the nurse properly prepares them. Sterilization is done at the

hospital, and the packages are returned to the patient with careful instructions not to in any way disturb the covers. These are to be left intact until opened by the nurse at the time preparations for delivery are being made.

At the onset of labor a visit to the patient is made. The examination at this time is usually limited to the abdomen. If it is found necessary to examine the condition of the cervix, the vaginal method is used. No vaginal examination is ever made without careful scrubbing of the perineum with soap and water, followed by Lysol solution. Sterile, dry, rubber gloves are always used, the hands, of course, having been previously carefully scrubbed. It is at this preliminary examination that I feel the greatest risk is taken. Personally, my obstetric conscience does not permit of less aseptic preparation than for an operation.

In the preparation for delivery, even in the most meagerly furnished homes, it has been possible to secure a satisfactory technic which does work out in practice. Naturally this necessitates carrying practically an operating room equipment to the home. A small portable copper sterilizer; such instruments as may be necessary for anything short of an abdominal section; sterile gauze, leggings, delivery sheets, sutures; solution for the infant's eyes, saline, mercurochrome, etc., are always packed and ready.

For a number of years it has been my practice to take a graduate nurse to each home confinement. In addition, when it is possible to do so, a senior pupil nurse accompanies us from one of the hospitals where the teaching of this branch is under my supervision. It is felt that in this way these young women can be shown that aseptic results are to be secured in surroundings most discouraging to the average graduate nurse, no matter how thoroughly trained, if she is inexperienced in home confinement. These student nurses are given a practical demonstration of home preparation.

For the past two years the mercurochrome preparation method has been used. It has proved to be eminently satisfactory and entirely practical. The nurse always gives an enema if the patient has not already had this, provided that the head is not engaged in the brim of the pelvis. The patient is then shaved carefully and washed with a solution of Lysol in boiled water. Mercurochrome is then applied over the abdomen from the umbilicus down; the perineum, the vulva, and the inner surface of the thighs to the knees are likewise painted with the same solution; one-half to one ounce of the mercurochrome solution is injected into the vagina, and lastly a sterile vulvar pad is applied. In case the labor is protracted, an additional half ounce is injected into the vagina at intervals of from two to four hours. During the period that this agent has been in use, no untoward effects have been noted. Four per cent solution is used both for the skin

and for injection into the vagina. One cannot but feel that if all physicians giving obstetric service in the home would adopt this method, the statistics so often quoted would at once show a decided improvement.

The patient once having been prepared, every effort is made and every precaution taken to avoid contamination. Sterile gown and gloves are always worn for these deliveries just as in the hospital. Naturally it is impossible to have the surroundings like those of a well-equipped institution. The effort is made to carry the principles of aseptic and practical antiseptic technic with us in this work and to apply them in actual practice. It is possible to do versions, instrumental deliveries, and immediate repairs (rather extensive in character) in the homes, as well as normal deliveries, and still secure satisfactory results. It has been a source of surprise and satisfaction to discover how well even extensive repairs progress, if these efforts to secure aseptic technic are constantly and conscientiously carried out.

In the management of labor in the home the same course is followed as is pursued in hospitals. At the onset a careful examination of the abdomen is made to determine the presentation and position; the relation of the head or breech, as the case may be, to the pelvic brim, and whether or not engagement has taken place. The fetal heart is located, and its rate and rhythm are noted. Experience in abdominal examination, after much practice, renders pelvic examinations, either rectal or vaginal, unnecessary in the great majority of cases, during the first stage of labor.

After satisfying myself as to the condition of the patient, I make it a rule to let her alone. The first lesson learned in my obstetric experience was a realization that the mechanism of labor was an unknown realm to me and that the understanding of this was of paramount importance, if one is really to become qualified to do satisfactory work. It was only after years of study and observation and experience that I was convinced that my place should be that of an observer on the side lines, so to speak, while nature was allowed the active rôle. The weak point, I think, in the practice of obstetrics, at least in the most of that done in homes, is due to the fact that the doctors did not understand the mechanism of labor when they were graduated, and have not grasped it since.

In the management of labor during any stage, but especially in the first, there is one thing to be discouraged. The patients should not be told to "bear down" or to make straining or expulsive efforts. My observation is that the only effect of this is an injurious one. It is more than a coincidence that we find the supports of the pelvic viscera so relaxed, and the bladder, uterus, and anterior rectal wall prolapsed to varying degrees. I am convinced that this so-called "bearing down" at an inopportune time is not only of no value, but in many instances is positively harmful.

Where conditions are progressing normally, the same course of watchful waiting is pursued during the second stage. I do not find that it is advisable in obstetric practice in the home to endeavor to assist nature by dilating the vaginal outlet. It is difficult enough to preserve asepsis, which is of prime importance, under such conditions, without undertaking the procedure of "ironing out" the perineum.

Experience and observation have shown me that the position of the patient's limbs is of importance during the completion of the delivery of the child after the presenting part begins to distend the vulvar orifice. I deliver practically all women in the dorsal position with the limbs extended upon the bed and the feet separated moderately. It is found that this causes an appreciable relaxation of the tissues about the vaginal outlet. In my experience flexing of the knees causes the structures of the perineum to be more tense and unyielding. Lacerations are not so frequently encountered and the necessity for episiotomy is not present to the same extent since this posture has been adopted. Anything which reduces the necessity for surgical procedures in home obstetrics has a very definite value. In my experience this position has proved valuable.

All lacerations are repaired immediately. It is felt that even slight first-degree lacerations of the vaginal mucous membrane, and of the skin about the vaginal orifice will provide a possible portal for infection. These slight tears are usually repaired before the delivery of the placenta and membranes. The bleeding is less, and this is to be considered where trained assistance is not available, as it seldom is in the home. If the lacerations are of the second degree, no repair is attempted until after the secundines are expelled. During this period the patient is allowed to react from the anesthetic, the nurse making preparation for the repair work.

One of the most difficult features of these repairs of a more severe nature is to keep the field reasonably free of blood, so that the structures may be approximated with a fair degree of accuracy. This is not an easy matter where no one is aseptically clean except the physician. It is my practice to administer a full cubic centimeter of pituitrin at the completion of the third stage. The subsequent contraction of the uterus, of course, lessens the difficulty of keeping the field fairly clear of blood. In repairs of cervical laceration the difficulties are often great. An expedient that I have found of great assistance when the perineal repair is begun is to place one or more large sterile scrub sponges, with a string or tape attached, in the vagina. Several packages of these sterile sponges are included in the list of supplies carried to each confinement.

In my repair work I always endeavor to bring the tissues together in separate layers, using interrupted sutures of either No. 1 or No. 2 chromic catgut. Personally this has proved far more satisfactory than an attempt to use a few deep through and through sutures which

include all of the tissues. It has been found that it is possible to secure satisfactory results in these repairs in the home with no assistance other than one nurse. The patient is turned across the bed with the hips brought to the side of it. A canvas leg holder with a loop for each leg is used to support the thighs, flexed to any degree desired. Sterile sheets protect the field and sterile sponges, instruments, and other needed supplies are at hand. The carrying out of this technic is not difficult if one has had some training and experience with it, and has been able to establish a definite routine of preparation.

After much study and trying out of various positions for forceps deliveries and the performance of versions in the type of obstetric service under consideration, a somewhat standardized procedure has been developed. Teachers of obstetrics from time immemorial have advised using the kitchen table, an unhinged door, etc. Personally I have never been able to discover kitchen tables which were satisfactory. They generally have one or more unreliable legs, are too high, too low, too short or too long. Doors do not have attachments which render them a suitable delivery table. In the face of these difficulties an effort is no longer made to find a substitute. The patient is turned across the bed and brought to the side until the sacrum rests on the edge. If two persons are available to support the limbs, they are instructed to sit on either side of the patient and each one supports a limb which is extended across his knees. The limbs, bed, and patient are protected by sterile sheets and towels. Where no individuals are available, it is found feasible to use two straight chairs with the backs turned toward the operator. The patient's limbs are extended, resting on the seats of the chairs, and the operative field protected with sterile drapes. The description may not be impressive; it can only be said that necessary operative procedures are carried out satisfactorily.

The management of the third stage is still one of assisting nature. It does not appeal to me that we should be in too great a hurry to deliver the secundines. After severing the cord between clamps, the uterus is watched for several minutes, one hand of either the nurse or the physician being placed upon the abdomen. The necessary attention is given to the infant; the cord clamp is applied, a sterile cord dressing adjusted after 1 per cent solution nitrate of silver has been carefully instilled in each eye and neutralized with normal salt solution. The child is then inspected for abnormalities. The nurse then proceeds with the cleaning and dressing of the baby, while the physician observes the mother's condition. If after an interval of thirty minutes the placenta and membranes have not been delivered, the uterus is massaged gently. In the majority of instances uterine contractions are so stimulated that the placenta will be expelled spontaneously. Rarely do we find it necessary to employ the Credé method.

Only in the rarest instances is manual delivery of the secundines necessary.

A postpartum hemorrhage at the beginning of my obstetric experience impressed itself so indelibly upon me that every precaution is taken to avoid a repetition of this. A full cubic centimeter of pituitrin is always given at the completion of the third stage, and a full dose of ergot by mouth, when the patient is able to swallow. Small doses of ergot are given to all patients who are delivered in the home at four-hour intervals for three or four days. It is felt that these procedures account, to some extent at least, for the absence of postpartum catastrophes, such as that mentioned above.

The question of anesthesia naturally presents itself. This is always dangerous ground upon which to advance in any meeting of medical men. Please bear in mind that the matter under discussion is that of obstetric service in the home of the patient, not in the delivery rooms of well-equipped institutions with skilled anesthetists available. The difference is unquestionably great. Much thought and study has been given to this phase of the work, and many different methods have been tried. In my own experience it has not proved satisfactory to attempt to employ rectal anesthesia in home confinements. There are many disadvantages to the use of ether in the home—open fires, evanescent effects, and so on. The use of nitrous oxide is not practical in the experiences I have had with it in this work. This leaves chloroform. In an experience of more than twenty years not one fatality has occurred to an obstetric patient from its use. It has been used carefully and with judgment. Morphine is given in the early stages when indicated. The dosage is usually small, and my experience is that its analgesic effects are enhanced if it is combined with small doses of hyoscine. Doses are repeated cautiously, depending entirely upon the progress of labor. Morphine in combination with magnesium sulphate has been tried. It has not proved so satisfactory, however, in my work as has the combination of morphine and hyoscine. It is found that if care is given to analgesia in the early stages of the labor, the completion of the delivery requires but little chloroform. In those cases where repairs are so extensive as to require anesthesia to a surgical degree, it is my practice to let the patient react while preparation for repair is being made; they are then reanesthetized, using ether. They do not stand a continuation of chloroform anesthesia well after the completion of labor.

I do not feel that one may neglect the after-care of these patients, if the best results are to be obtained. It is customary to continue daily visits for at least ten days, longer if necessary. A careful supervision of the after-care is exercised. This has been found necessary in order to prevent pernicious meddling by officious and superintelligent practical nurses and kind-hearted neighbor women who are helping out.

A case in point is in regard to giving parturient women intravaginal douches after the second day. It may surprise you to know that even in this enlightened day, in a city of 90,000 population, physicians still advise this. For some years much opprobrium was cast upon me because this time-honored procedure was so ruthlessly done away with.

The diet is advised. It is felt that the danger in home obstetric work is that of overfeeding for the first few days. Consequently one gets a reputation that he is too "cranky" about the food. Regardless, I continue the even tenor of my way, and in the end the results prove satisfactory to all parties concerned.

Patients are instructed as to the value of exercises in the bed after the third day, following out the method advocated by the Obstetrical Department of the Long Island College Hospital.

Finally, it is insisted upon that these women report to the office for an examination at the fourth or fifth week postpartum. In my opinion, we have not rendered our full measure of service until we are sure that their condition is one of normalcy.

At present the advisability of employing an additional nurse who will be put on an hourly nursing service to obstetric patients in their homes is under consideration. She would be expected to visit a certain number of patients each day, bathe the mother and child, take temperatures, advise the diet for the day, give enemas, etc. This idea has not been fully matured as yet. It can be seen where it would greatly enhance the service to those patients in moderate circumstances from an economic standpoint. Whether or not it can be accomplished without adding to their financial burdens remains to be seen.

These procedures from the first visit of the patient to the office to the time of their discharge are time-consuming and often tedious. Yet, if one is interested in securing the best end-results, they are more than worth while. Obstetricians of this type must of necessity be men enthusiastically in love with their work. Many patients cannot reward one financially to the fullest extent; they will pay to the limit of their ability, however, and it is personally found that the satisfaction of work earnestly and conscientiously performed more than makes up the deficit.

#### SUMMARY

1. The majority of confinements still occur in the home.
2. Pregnant women are certainly entitled to the very highest type of obstetric care.
3. It is possible to give this care in the home, if we earnestly strive to do so.
4. End-results prove that it can be accomplished in actual experience in a fairly large practice of this character.



## Society Transactions

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AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS AND ABDOMINAL SURGEONS

FORTIETH ANNUAL MEETING

ASHEVILLE, N. C., SEPTEMBER 15, 16, 17, 1927

DR. DAVID W. TOVEY, New York City, read a paper entitled **Ladin's Sign of Early Pregnancy Compared With Hegar's**. (For original article see the current volume of the Transactions of the Association.)

DR. JOSEPH B. BACON, Macomb, Ill., read a paper entitled **A New Technic and a New Instrument for Operating on Rectal Stricture**. (For original article see the current volume of the Transactions of the Association.)

DR. DAVID HADDEN, Oakland, Cal., read a paper on **The Significance of Retrodisplacements of the Uterus and the Principles Involved in a Satisfactory Correction**. (For original article, see page 373.)

### DISCUSSION

DR. WALTER T. DANNREUTHER, NEW YORK CITY.—It would be futile for one to attempt a discussion here of the comparative merits of the many operations that have been devised and advocated for the correction of retrodisplacements, but I believe that it is wise to place the stamp of disapproval again upon the Kelly suspension operation. Attending a clinic recently in another city, I was astonished to see the operator do two of these operations, despite the fact that I thought that most gynecologists had long ago been convinced that an intended suspension usually eventuates in either a fixation or a recurrence.

It is always necessary to differentiate cases of retroversion that are congenital from those that are acquired. A congenital uterine displacement produces no symptoms and requires no treatment. The symptoms, if any, are due to the incidental hypoplasia and not to the displacement, and any form of therapy directed to the correction of the displacement will result in disappointment. In cases of acquired retroversion, a distinction must be made between the so-called uncomplicated and the complicated ones. As a matter of fact, the retrodisplacements that are regarded as uncomplicated often give rise to symptoms because of the associated venous stasis in the perimetritic structures. This explains the insidious and delayed onset of symptoms so frequently observed.

A word regarding the pessary. I have removed pessaries from patients that have been inserted upside down, or back to the front, and in one instance both of these mistakes had been made. It is quite possible that the disrepute into which the pessary has fallen is due largely to the ignorance of some of those who apply it. A pessary cannot be expected to correct a retroversion. It is simply a device to hold the cervix back after the uterus has been replaced by the physician.

The various curves are designed for specific purposes, and if the principles upon which a pessary is moulded and constructed are thoroughly understood, this useful instrument will be misused less often.

DR. D. L. JACKSON, BOSTON, MASS.—In the operation for the correction of retroversion, we always have to consider the fascial shortening on the anterior wall of the vagina which holds the cervix forward. It is very simple to make a transverse slit at the bladder junction with the cervix, push the fascia upwards, and then sew longitudinally, thereby correcting that fault and allowing the cervix to drop back so that we do not get an ante flexion of the cervix when the retroversion is corrected.

DR. HERMAN E. HAYD, BUFFALO, N. Y.—I agree with a great deal that all of the speakers have said, and perhaps disagree with some of them on some points. There is no question that we cannot do anything for a congenital retroversion. You may hitch it up, but the patient will suffer just the same. The classification that Dr. Dannreuther has made is very practical: those that have borne children and those that have not. Those who have no infection of tubes or ovaries will be cured by any kind of a round ligament operation. Those who have borne children have a disturbed pelvic outlet and that is the difficulty in connection with those cases.

Dr. Hadden seems to prefer the Webster operation. I have given up that operation altogether. I have given up all kinds of operations that involve the perforation of the broad ligament. In the first place, there will be adhesions, and the worst kind of adhesions follow that operation. Secondly, the incidence of a possible phlebitis is such as to contraindicate it. After all there is no operation that gives me as much satisfaction as the one done by the late Dr. Mann, where he simply loops the round ligament, and if the case is complicated by a fallen tube and ovary, it is a very simple matter to hitch up the ovary with a few stitches, and in doing so you will hitch up the tube. There is no question in my mind that a retroversion will sooner or later produce symptoms.

DR. GORDON K. DICKINSON, JERSEY CITY.—There are two kinds of wisdom: one is the wisdom of the operating surgeon who has found a cure in a certain specific method; the other is the wisdom of the older man who has tried every method and failed in all of them.

My experience is that we are developing slowly along this line. Ten or fifteen years ago there were only one hundred methods of operating for retrodisplacements; now the doctor tells us there are one hundred and twenty. We are not centralizing on this because in our work we are not thinking, but are trying to follow a beaten path instead of working out each individual case and trying to treat it accordingly. We are all prone to forget that we have the patient as well as the condition. Some women have retrodisplacements and suffer, while others do not suffer, showing that there is a large neurotic element to be considered.

Dr. Dannreuther speaks of the venous congestion. It may be venous or capillary. I find that it is necessary to add to the operative procedure medical treatment. I have found apparently a specific effect in relieving the congestion by stimulation of the circulation in the pelvis by strophanthus. We must also add proper hygiene, vigorous exercise, and out of door life. The scrub woman and women in active life never complain of this condition. It is the sedentary, the fashionable woman, who has not enough exercise to throw the blood through the capillaries, who has trouble. We, as surgeons, should be hygienists and physicians as well, but there is no one type of operation in my experience which is going to give us 100 per cent results.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—In considering the pathology of this condition, grossly one finds the uterus is enlarged, the endometrium congested,

the stroma hypertrophied or passed on to a condition of hyperplasia. The blood vessels have thickened. In other words, there is an early state of passive congestion. Later there is a condition of atrophy in the face of the condition of an enlarged and heavier uterus than normal. A cross-section of the wall will show that the tissue has changed and it is easy to observe with the naked eye that the walls are thickened and that the organ is not receiving a normal blood supply. Microscopically one will see that the nerve trunks have enlarged. Many uteri are removed by the operator because he has suspected myomas or fibromas, and when sectioned it is often a surprise to find only atrophy and fibrosis.

Reasoning from this picture of ultimate change, it is quite apparent that something should be done, a suspension, or some form of exercises following delivery, as J. O. Polak has advocated, or some other procedure to prevent this very obvious pathology. This can be a decision of importance in each individual case.

DR. HADDEN (closing).—I read the last two pages of my paper so hurriedly that I fear Dr. Hayd did not get my meaning. I severely criticized the Webster-Baldy operation, but what I do under favorable conditions is not the same operation. The Webster-Baldy operation can be improperly done in many ways and you see more failures from that than perhaps from the Gilliam, but it is when properly done, very effective.

DR. FRANCIS REDER, St. Louis, Mo., read a paper on **The Treatment of Vaginismus**. (For original article, see page 420.)

#### DISCUSSION

DR. LOUIS E. PHANEUF, BOSTON, MASS.—I want to emphasize the satisfactory method of operating by means of local anesthesia. I have operated upon two women recently, using morphine and scopolamine, and half of one per cent novocaine, injecting the mucocutaneous border and depositing about 5 c.c. of the solution in each levator. These women have consented to operation readily on finding that they would not be submitted to general anesthesia. I used a median incision, splitting in the middle line, and sewing laterally with perfectly satisfactory results. I have also delivered some of the women whom I had operated upon by this method.

DR. JAMES W. KENNEDY, PHILADELPHIA, PA.—During the past three years I have seen more cases of vaginismus than I have had during my entire previous experience. It is a real pathologic entity, and we have learned to be more considerate toward the patient than in former years, when we looked upon vaginismus as more or less of a neurotic condition, having little true surgical pathology. I recognize the condition as either a true vaginismus or a pseudovaginismus. If we recognize the pseudovaginismus as a symptom secondary to some local irritating conditions, such as urethral caruncle, inflammation about the meatus, painful fissures in the region of the vaginal orifice or the anus, rigid hymen, or that painful neuroma which may be a remnant of the hymen, then of course we have a happy solution of the annoying condition. I have seen a number of patients have a paroxysm of the muscles of the vaginal introitus if the examiner merely touched a skin tag which marked the remnants of the hymen, and I have also seen the same symptom emanate from simply palpating with the finger a tense nabothian cyst of the cervix.

Some of these patients are in need of sympathy and investigation from a nervous standpoint, others need surgery but they are all worthy of careful investigation.

DR. ADAM P. LEIGHTON, PORTLAND, ME.—This seems to be a malady from which the women in Maine suffer tremendously. It has been my peculiar experience to meet a number of them, and to follow them through to the divorce courts. It seems that many of these cases can be cured, and the penalty that follows married life may be avoided if we only intelligently try to treat these individuals.

One or two points have not been mentioned. Cases of recurring pyelitis have been the cause of vaginismus on several occasions, and cervical erosion with the resulting leucorrhœa, which is sometimes overlooked, may be treated with a cautery and relieved. Another thing, a very small matter possibly, is the fact that many of these women have an alkaline urine, causing vaginitis and vulvitis and thereby irritating the hymen tags, which being changed to a normal acid reaction aids in a cure of the disease. The carunculae myrtiforme may be cut off, the Sims' glass dilator used and cocaine ointment applied. Where the urine has been changed to its normal acidity, good results have followed in many of these cases.

DR. HUGO O. PANTZER, INDIANAPOLIS, IND.—I wish to allude to one additional course in the treatment of these cases; namely, the mental influence of the patient over the condition. In some cases a curative effect may be obtained by having the patient practice relaxation of the perineal musculature, and doing it often during the day. It is surprising how many of these cases will respond under such practice.

DR. REDER closing).—Dr. Pantzer's suggestion about the psychic influence is a very good one, but the difficulty I have experienced is that almost anything may offend these women. All in all these are difficult cases to deal with.

DR. WILLIAM P. HEALY, New York City, read (by invitation) a paper on **Early Diagnosis of Cancer, Particularly From Gross Characteristics**. (For original article see page 353.)

#### DISCUSSION

DR. JAMES E. KING, BUFFALO, N. Y.—I believe that one of the frequent mistakes that the general practitioner makes in the diagnosis of cancer of the cervix is due to the teaching and belief that cancer of the cervix is essentially a disease of middle life. It has been my rather unpleasant experience to have found carcinoma in young patients and, without exception, they have been sent to me by physicians who confessed that failure to make the diagnosis was because the patient was under thirty. We should begin to correct this impression, for cancer is no respecter of age. In regard to the early tissue changes in cancer of the cervix, we must remember the various types of the proliferating and infiltrating growths, because of the difference in their prognosis and the ease in diagnosis. The proliferating type is, of course, very much less likely to extend early than is the infiltrating type; and, on the other hand, the proliferating type is much more easily discovered because it occurs on the cervical surface as an outgrowth.

The one type that occasions the most difficulty in diagnosis is the adenocarcinoma that develops in the canal of the cervix. I want to emphasize the fact that in suspicious cases the use of the sound is always of great help. Adenocarcinoma that develops in the canal can often be suspected where the sound in the canal produces bleeding, for it is seldom that a normal canal will bleed on the passage of a sound.

DR. HENRY SCHMITZ, CHICAGO, ILL.—We have adopted a very simple method of teaching the student the early diagnosis of carcinoma of the cervix as follows: The first stage is a nodule. A nodule is more often benign than it is malignant. If the nodule is incised and bleeds, it is probably malignant; if mucus exudes, it is probably benign. Hence, an immediate excision for diagnosis should be made. The second stage is an ulceration. The ulcer is usually small and has sharp, moth-eaten edges, and may be surrounded by an area of induration. If the ulcer is touched with a sound or a cotton applicator, bleeding will ensue. Free arterial bleeding probably means cancer. Hence a diagnostic excision should be done and a microscopic diagnosis made. If a carcinoma of the cervical canal or of the body of the uterus is suspected, then a sound should be inserted carefully and with

strict aseptic precautions. If bleeding ensues, and particularly if it continues for some time afterward, the supposition is that the patient has probably a carcinoma and a diagnostic curettage and microscopic examination of the scrapings should be made.

One should remember that carcinomas of the body of the uterus and of the cervical canal are very treacherous, as the external os may be perfectly intact. There are no characteristic symptoms of early carcinoma of the portio cervix or corpus. If bleeding occurs, we should suspect carcinoma until we can disprove it by microscopic evidence.

If the diagnosis of the early stages of cancer is taught, as Dr. Healy has suggested, and a woman will come to the doctor at about forty years of age for a health survey and repeat this at regular intervals, quite a number of early uterine cancers will be discovered, and of course, the good end-results of treatment will improve.

DR. W. S. BAINBRIDGE, NEW YORK CITY.—I was particularly impressed with the emphasis which Dr. Healy placed upon the importance of the clinical side in the diagnosis of cancer. It seems to me that the responsibility is with the clinician, and while he should not minimize the value of the pathologic tests, he should keep himself in close touch with all possible sources of information from a clinical standpoint. We do not always have the balanced judgment, but lean too much to one side or to the other.

I wish that I could feel that in our own country, as in Germany, the microscopic diagnosis is correct in 99 per cent of the cases, as reported by Dr. Strassmann. The percentage of accuracy in our laboratory tests is, I believe, much lower than this. Of course, the obvious case is not the difficult one: it is the borderline type. In one instance, I sent a set of slides for pathologic analysis to laboratories in Paris, Berlin, Rome, and to eight of the leading laboratories of this country, and I received seven different diagnoses of the one pathologic specimen, in return. These included diagnoses of sarcoma, carcinoma of the various types, tuberculosis, syphilis, and Hodgkin's disease. I may add that a succinct record of the clinical aspects of the case accompanied the set of slides.

There are one or two points where Dr. Healy may not have made himself clear. I do not think that he meant to say that one out of every ten human beings living today will die of cancer. Even the most extreme statistics do not present such figures. The accepted records show that of those over thirty-five years of age one out of every seven women will develop cancer, or die of cancer, or die with cancer. If we include all children and persons under thirty-five years of age, we cannot say that one out of ten of the human family will die of cancer.

Finally, the investigation of the Metropolitan Life Insurance Company of 125,000 deaths from cancer among one million industrial policy holders, concludes that "the actual increase in the death rate is small \* \* \* much smaller than might be inferred from analysis of published death rates."

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—Frequently in our routine practical work we proceed at times in a hysterical way to the diagnosis of cancer. When a case is presented to the surgeon, physician, or pathologist, a very prompt and hasty diagnosis is expected. This is very difficult in many instances when you consider all of the factors involved. In the far-advanced cases one is dealing, of course, with a very easy problem, but in the cases that are being discussed today, diagnosis is difficult. One is called into the operating room from time to time and asked to pass upon certain tissues by instant ocular examinations. A more adequate opportunity should be provided by assembling of the complete data and a more extended examination permitted.

Dr. Healy has quoted Maude Sly in regard to the value of heredity, and also as to the significance of irritations. It takes a little time to develop the history

of old and forgotten irritations in the area of newgrowth. I believe we are not in a position to diagnose these very difficult cases until we have the data all before us. The only logical and safe way of proceeding is by the eliminative method. I am in the habit of teaching my students that the whole field of pathology can be encompassed by making a few simple divisions. First, consider malformations or developmental defects; second, consider vascular conditions; third, inflammatory conditions, and fourth, whether it is a degenerative or a newgrowth change of benign or malignant type.

If one will leave the cancer decision until the last it may be easy to rule out a malformation or a developmental defect. Then proceed to the other conditions, and one will find the greatest trouble with the inflammatory changes which include the other types of changes. The most frequent decisions will need to be made between the inflammatory and newgrowth changes.

DR. F. S. WETHERELL, SYRACUSE, N. Y.—I would like to ask what Dr. Healy's view is in regard to treatment of early carcinoma of the cervix; whether he is using radium in all cases or whether in some of the very early cases he resorts to hysterectomy? I would particularly like to know what his experience is with adenocarcinoma of the cervix. Some men working in this field say we may treat squamous-celled carcinoma with radium, but that adenocarcinoma is resistant to the gamma rays.

DR. HEALY (closing).—Replying to Dr. Bainbridge, I probably left out the word "Adults." I meant to say that one of every ten adults will die of cancer, according to the statistics we handled, and one in every five women between the ages of forty-five and sixty-five. That is all right if you have a gambling instinct. You can say you have a ten to one chance anyway and need not worry about it. But those are facts.

We are endeavoring to discuss diagnosis at the time when cancer is, in our opinion, curable and that of course is not in the textbooks.

In regard to the question of adenocarcinoma of the cervix, those cases that develop in the canal usually are infiltrating and are advanced when they come under observation. They are not any better or any worse than the infiltrating epidermoid carcinomas. If in a very favorable case of cervical cancer you see fit to do a Wertheim operation, you may do so, but we feel that the patient will do perfectly well without that operation and without the risk of mortality if she is treated with radium, either with or without x-ray. We combine x-ray with it. Some very excellent men use radium entirely. We believe irradiation in the early stages will give better results in the sum total of cases, without morbidity and mortality, than surgery.

Address, on Lawson Tait and His Contributions to Abdominal Surgery, by DR. JOHN HARVEY KELLOGG, Battle Creek, Michigan. (See the current volume of Transactions of this Association for this address.)

DR. P. BROOKE BLAND, Philadelphia, Pa., read a paper entitled Hydatidiform Mole—Is the Expectant Plan of Treatment Justified? (For original article see page 390.)

#### DISCUSSION

DR. PALMER FINDLEY, OMAHA, NEB.—I take it that Dr. Bland is of the conviction that a mole can be judged as to its malignancy by a microscopic examination; and I am aware that he has abundant support in the position he assumes. Neumann states that the chorionic epithelium suggests malignancy; Mutz thinks

that the deep invasion of the musculature suggests malignancy. These and other authorities suggest that we have a reliable means of judging whether a mole is malignant.

Recently a splendid article has come from Hitchmann in which he says we have no reliable guide as to the malignancy or nonmalignancy of these moles.

I was first interested in the subject in 1903 when I searched the literature, going back as early as the sixth century. I could find only 210 cases—a most insignificant number as compared with the number that must have occurred during that long period. There was 25 per cent mortality, 16 per cent of which was from malignancy. I do not believe that that was an expression of actual facts. Most of the cases were recorded because there was some eventuality of special interest, sepsis or malignancy or what not.

I wish Dr. Bland would try to gather some evidence as to the frequency of hydatidiform mole. We hear that it is as high as 70 per cent in the early interruption of pregnancy and that it is exceedingly frequent in normal deliveries, even as high as 30 per cent of the placentas showing some myxomatous changes.

I would like to make this suggestion, as I did in 1903, that if two weeks after a mole is delivered there is found in the scrapings actively proliferating epithelium, a hysterectomy be done.

If there is no evidence of malignancy at this time, there would likely be no malignant development in the future.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—The work of Dr. Blair Bell, in England, in the lead treatment of cancer received its greatest impetus in this worker's mind after he had studied the biology of the placenta.

It is most interesting that in this condition we have both a degenerative process and a newgrowth occurring perhaps at the same time, or at least the newgrowth process follows quickly after the degenerative process.

The mesothelial stroma of the villus begins to degenerate and is the first sign we can recognize to enable diagnosis of this condition. This degeneration in the central part of the mesothelial stroma will progress until the entire stroma has been destroyed. Then the activity of the border epithelial cells appears to begin in earnest, and an actual secretion is thrown out sufficient to fill the cavity left by the degenerative process.

In regard to the change from the benign condition to the malignant. It is often difficult to differentiate these two conditions. However, the same criteria used in diagnosing difficult cases of malignancy should be applied here. It is the differentiation of the cells—their departure in this differentiation process from the normal. The normal type of epithelial cell in the chorionic villus may grow and differentiate, and there is just a little departure from normal. That departure increases greatly as the invasion takes place into the uterine wall, and it is upon that change we must rely most for our differential diagnosis of the condition.

DR. BLAND (closing).—The clinical records at the Jefferson and St. Joseph's Hospitals disclose ten cases which had been recorded during the last few years. Six of the patients developed chorionepithelioma; four recovered and two died. Four of the patients had simple benign moles. Two recovered and two died of hemorrhage.

DR. HENRY SCHMITZ, Chicago, Ill., read a paper on *The Etiology and Treatment of the Bleeding Uterus*. (For original article see page 344.)

#### DISCUSSION

PROF. STRASSMANN, BERLIN.—I agree with all that Dr. Schmitz has told us. It is interesting especially to see the difference in the cases of bleeding uterus that occur in the years from fourteen to nineteen or twenty and those which occur at

about fifty years of age. In some of those cases nothing but conservative treatment really helped. The chlorosis of young girls has almost disappeared for some years, perhaps because no compressing of the organs by a corset now exists. The number of cases of bleeding uterus has increased very much. Everything possible should be done to build up the constitution. We give endocrine remedies, but they do not often have much effect. Dr. Thaler, of Vienna, proposed to make an incision, take off a part of the ovary, and sew it together. Personally, I do not like to use x-rays in such young patients. We now make irradiation of the spleen, and sometimes that is of benefit.

I remember one patient who had had this condition until her twenty-seventh year. Curettement was performed several times and all conservative methods of treatment exhausted. She had a child but developed afterward the same condition. We could find nothing in the uterus or ovaries to account for it. When we performed extirpation of the uterus, because nothing else would help her, we found sclerosis of the uterine arteries. There will be a certain number of cases, where you cannot help the patient in any other way than by operation.

DR. WM. P. HEALY, NEW YORK CITY.—I assume from the way Dr. Schmitz handled the topic that he was trying to avoid as much as possible the question of malignant disease and that he was considering benign conditions. Naturally it divides itself at once into the intrinsic uterine conditions and those that are outside the uterus. Our attitude will vary, depending upon the patient's age. When a young girl appears with symptoms of menorrhagia, we decide we must be dealing with a condition of endocrine imbalance. Occasionally it will be a combination of imbalance plus displacement.

I feel as Dr. Schmitz does, that we should avoid the use of radium in these young women. I think curettage is justified when other treatment fails. As a matter of fact, when these girls of fifteen or sixteen are sent to us at the Memorial Hospital, we never curette them. We put them on endocrine treatment and keep them in bed. We almost invariably correct the situation along medical lines. However, occasionally we have a patient who will not respond to medical treatment or curettage, and we then give them a small intrauterine dose of radium.

DR. PERCY W. TOOMBS and DR. I. D. MICHELSON, Memphis, Tenn., presented a paper on **Clostridium Welchii Septicemia Complicating Prolonged Labor Due to Obstructing Myoma of Uterus. Report of Case.** (For original article see page 379.)

#### DISCUSSION

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—These types of infections may be carried in from without by the operator or attendant. The most common source is from the intestinal tract. The *Clostridium welchii* may be found in the lower intestinal tract of most individuals. This leads to important clinical considerations. Why is it that we have such a serious condition to deal with in the cases of *Clostridium welchii* infection? The only rational explanation is that many of the organisms do not produce a toxin. There are some strains that evidently produce very dangerous toxins, and it is in these cases that serious results usually follow.

From the clinical or operative standpoint, a very practical observation may be made; namely, that the symptomatology of stasis that carries on to the condition called ileus, or to peritonitis, if compared with known cases of infection from the *Clostridium welchii*, will impress one with their almost exact similarity. It is usually very discouraging to meet in surgical practice a case of ileus or stasis because it is progressive.

The essayist in his classification has referred to two groups: the group where abortion has occurred, and the nonaborted group. In the latter group he has



spoken of obstruction in practically every division he has made. So in a practical way it is very important to remember that these three conditions may be identical.

The standardized treatment of ileus is drainage. Adequate drainage has been the best treatment up to the time that antiserum has been used, and in the results derived from the antiserum treatment, it has been observed that just as soon as the bowel begins to move normally, or continues to move normally, the patient usually commences to improve. It would be rational treatment to begin the serum whenever there is ileus or where there is a progressive stasis, or a peritonitis with marked progressive stasis. (See report of experimental work in the *Brit. Med. Jour.*, Vol. XIV, October, 1926.)

DR. L. A. CALKINS, UNIVERSITY, VA.—We have had two cases within the last year and a half. I saw each of them about forty-eight hours after the first incidence of increase in temperature. In neither was the diagnosis made until the time of delivery and the presentation was normal in both cases.

The first case was that of a multipara whose membranes ruptured early. The fetus in this case was extremely edematous. Pure cultures were obtained from the tissues of the body of the child and from the blood of the mother. This woman died six hours after delivery.

The second patient was admitted to the hospital, six months pregnant. We tried to get some confession of interference. The physician had not examined her. She came in with a temperature of 103°, pulse 130, membranes unruptured, slight labor pains, and no bleeding. We did not suspect gas-bacillus infection until she miscarried, about thirty hours later. The membranes ruptured, and the amniotic fluid was frothy. In three instances pure cultures of gas bacillus were obtained from the blood. This woman was immediately put on large doses of antitoxin. Within twelve hours this patient's temperature became normal or subnormal and remained so for a week. Her hemoglobin had dropped from 65 at the time of delivery, with almost no blood loss, to 40 the following day. Forty-eight hours after delivery the hemoglobin was 30, and in the next twenty-four hours it was 23. It took us about forty-eight hours in her case to obtain donors. We then started transfusions, and the hemoglobin not only came up but stayed up after the transfusions.

Coincident with the rapid decrease in hemoglobin, there was an appearance of marked jaundice. This also cleared up following the transfusions. This patient has remained alive now some time over two weeks following delivery. Another clinical feature was variation of the leucocyte count with no apparent rhyme or reason for the increase and decrease. Four days following delivery she developed complete anuria. She passed in the next forty-eight hours less than 50 c.c. of urine; then gradually the kidneys began to secrete and the day before yesterday she passed 3000 c.c. of urine, yesterday 4500 c.c. (Subsequent Note.—Blood urea rose to 84 and the patient died of uremia. Postmortem revealed moderate pericarditis as only focus of infection.) She had not had at any time a typical bluish discoloration of the skin.

DR. FREDERICK H. FALLS, Chicago, Ill., read a paper entitled **A Study of Pregnancy and Parturition in Primiparae with Bicornuate Uteri.** (For original article see page 399.)

#### DISCUSSION

PROFESSOR P. STRASSMANN, BERLIN.—This paper was one of the reasons, why I made a journey to your country.

We have heard about the bicornuate uteri and the dangers to the mother and baby. It is very necessary to have an operation that will give us living mothers

and living babies also. Here nature has forgotten to unite the two halves of the womb, therefore, these patients have dysmenorrhea, abortion, premature labor, placenta previa, breech presentations, obstructed labor, and puerperal fever. They have also chronic inflammations of the appendages and wrong diagnosis, or useless operations. They are now operated upon by uniting the two halves into one cavity.

For the uterus bifidus, the so-called double uterus—I proposed a new operation. We have to differentiate between the uterus didelphys (bicornis and the uterus bilocularis (septus) with or without double vagina. The bicornuate uterus must be incised from one horn over the saddle to the other horn. Then we unite the right and the left halves with deep and superficial catgut sutures in a similar manner as in cesarean section. Altogether I have operated on 22 patients. I operated thus even in a case of hematocolpos and hematometra of the right side. At first I opened the closed right vagina; the blood escaped, and the hematometra was emptied. The next menstruation was painful; a tumor still remained. I had to remove the right tube for hematosalpinx. In that second operation I reunited the two halves of the uterus. This patient has since the operation been delivered of a baby out of the reunited uterus. The new uterus does in those cases not rupture; it holds fast.

I have also resected the uterus in the earlier months of abortion. One of my patients was bleeding; she wanted to have a baby; but the uterus could not safely be emptied in the usual way. Abortion had to be finished by scraping the right half of the womb after colpotomy and opening the fundus. I reunited the uteri by the same operation (vaginally), but she has not yet had a child.

In other operations I had to deal also with the chronic inflamed appendages.

In infected cases, where there is already inflammation of the appendages, the patients will return to normal condition, when they get a "united uterus."

The uterus septus is treated by cutting the septum and closing the cavity without any loss of substance, just as cutting the vagina septa. Afterwards there will be normal conditions for confinement.

DR. WALTER T. DANNREUTHER, NEW YORK CITY.—I have had 13 cases of malformation in twenty-one years, and one of the most important features of Dr. Fall's presentation, from the teaching standpoint, is that it controverts the legendary ideas that these patients are usually sterile. Eleven of my patients were married, and six of them produced collectively 16 children and 11 miscarriages, and 8 of the miscarriages were induced. So it is obvious that the incidence of pregnancy is as high in these women as in others.

Dr. Fall was fortunate that the uterus in his first patient was of the septate type. It is sometimes difficult to distinguish the septate from the bicornate uterus during pregnancy, and whereas a rupture of the "dividing membrane" might be comparatively safe in the septate anomaly, it might also be extremely dangerous in the bicornate uterus.

The high position of the bladder in cases of bicornuate uteri is to be expected, because the peritoneal reflection of the bladder is carried up into the sulcus between the corpora and fuses with the peritoneum of the culdesac, thus forming the rectovesical ligament. In operating on these patients, as I have had occasion to do for fibroids several times, it is always wise and usually essential to divide this rectovesical ligament well back on the cleft between the two uterine bodies, to free the upper limit of the bladder. The generous transverse incision across the uterovesical peritoneal fold that is customary in the technic of an ordinary hysterectomy would jeopardize the bladder wall, hence, the necessity of the preliminary detachment on the posterior surface of the sulcus.

DR. LOUIS E. PHANEUF, BOSTON, MASS.—My experience has been limited to three cases. I had one case that I followed through five pregnancies, three pregnancies in the right horn and two in the left. Unfortunately, I was not able

to obtain a living child. The longest pregnancy was for six months. I operated upon this patient after a second pregnancy, dividing the vaginal septum and removing a myoma at the junction of the two horns.

DR. FALLS (closing).—Concerning the remarks of Dr. Dannreuther regarding the difference between the septate and bicornuate uterus, I wish to say that bicornuate uterus is a broad term which embraces several varieties. The most extreme degree of bicornuate uterus is the uterus didelphys. The uterus arcuatus is the simplest form. The uterus septus and the uterus subseptus are variations between these two extremes.

Regarding the discussion of Professor Strassmann and his operation on the true bicornuate uterus. This operation implies a true separation of the two horns of the uterus. Uteri of this type have given such distortion and are so striking clinically, that numerous reports have been made in the literature. On the other hand, we could find nothing concerning labor occurring in the milder types of bicornuate uterus, such as the uterus arcuatus and uterus septus. It is logical, however, to expect that the milder degree of uterine deformity would be more common than the extreme degrees, and it is probable that because complications are less constant and striking that this condition has been overlooked. When an oblique or transverse presentation occurs in a primiparous woman, it is well to consider the possibility of one of the milder forms of bicornuate uterus. Such patients must be watched more carefully than those with a normal pear-shaped uterus. My first experience with this type of case surprised me considerably. I recognized that something was wrong because of the position of the head and the rapidity of the heart tones. I was struck by the fact that two babies died in this type of uterus without other discernible cause. On searching the literature I found nothing covering this particular type of case. Since we have been observing these cases, members of my dispensary staff send in patients with a notation regarding this deformity. Almost invariably labor in these women will show some abnormality, whether it be a postpartum hemorrhage, version, or extraction, a necessity for forceps or manual removal of the placenta, or some other complication.

DR. EDWARD SPEIDEL, Louisville, Ky., read a paper on **The Vomiting of Pregnancy**. (For original article see page 411.)

DR. PAUL TITUS (reader), DR. PAUL DODDS, and DR. E. W. WILLETTS, Pittsburgh, Pa., presented a paper on **The Fluctuation of Blood Sugar During Eclampsia, and Its Relation to the Convulsions**. (For original article see page 303.)

#### DISCUSSION

DR. F. S. KELLOGG, BOSTON, MASS.—Regarding Dr. Speidel's paper. During the past three years we have followed in the hospital a routine treatment of vomiting of pregnancy with marked success. With this treatment we have done many less therapeutic abortions than before for this condition. We have as a routine given forced hourly feeding, forced fluids, large amounts of bromides, and isolation; stomach washings when the patient persisted in vomiting in spite of these measures, and last but not least, the removal of the vomiting pan from the room so that if the patient vomits she must do so on the floor or on the edge of the bed.

Forced feeding consists of giving the patient water, milk, and malted milk alternately every hour from 7 A.M. to 9 P.M., and one quart of glucose solution (5 per cent) every four hours by rectum. The glucose instead of being given as before in tap water, is given in slightly hypertonic or normal saline solution, for the reason that a careful study of the stomach contents has shown that there is no

free hydrochloric acid in the stomach in these cases. One quart of salt solution every four hours by rectum alternating with the glucose is used as well from 7 A.M. to 9 P.M. Salt and glucose under the skin and occasionally intravenously are used as needed if the rectum rebels. From 6000 to 7000 c.c. of fluid—glucose, salt solution, water, and food are used in a day. Thirty grains of bromides are given in each alternate tap. The nights are left free from treatment. If the patient vomits persistently after treatment is well established, the stomach is washed after each vomiting. The response to that treatment has been at least 300 or 400 per cent better than our results previously under any modification of this régime. It is a very rare thing now for us to do a therapeutic abortion, although we get some patients in very poor condition.

One more detail which we have found valuable is that we do not starve the patients for twenty-four hours as we did, because so many patients have been thrown from a mild degree of acidosis into a severe acidosis by this starvation period. We start feeding immediately.

Regarding Dr. Titus' work concerning blood sugar in eclampsia, it is a most stimulating and productive thing. Technically, it is very difficult to do, and he and his associates are, I think, entitled to great credit. The investigation shows that this blood-sugar phenomenon undoubtedly exists in eclampsia, that all the work that has been done on blood chemistry in eclampsia needs to be reconciled and checked, although we should be very guarded in drawing sweeping conclusions from it at the present moment and in attributing the convulsions to the low blood sugar necessarily.

DR. GEORGE W. KOSMAK, NEW YORK CITY.—In taking up Dr. Speidel's paper there is very little to be added as he has summarized in an exceedingly complete fashion all that we know of the modern treatment of the vomiting of pregnancy. I fail to note, however, that he paid sufficient attention to some of the reflex causes of vomiting. For a time we were led to disregard many of these reflex causes and direct more of our attention to methods of treatment that were apparently based on laboratory studies. I am firmly convinced, however, especially basing this on observations of recent years, that the condition of the cervix is a very important factor, particularly in the younger women. I believe it is quite necessary in the very early case, where vomiting is a more or less prominent symptom, to make a visual inspection of the cervix and to correct the erosions that we so often find. We are accustomed to look for these things in older women, and yet I have been surprised in recent years to find that a large number of young pregnant women with local lesions of the cervix, who vomited considerably, have improved when the lesions were corrected.

Another cause for serious vomiting, which is often overlooked is gastric ulcer, and this is particularly noted in young women who present a very anemic appearance and in whom vomiting of blood constitutes one of the symptoms.

One more important point is that abortion in these girls should not be long delayed. Too often in the past we have tried everything and then found that abortion threw the balance in the wrong direction. Abortion should always be considered, especially in women of the highly nervous type. I have seen a number of cases of mania where abortion was not done until it was too late to accomplish the desired relief.

Dr. Titus' paper is one of the most convincing arguments for a line of definite, specific treatment in the toxemias of pregnancy that I have ever listened to. Whether others will show the same thing in checking up his results remains to be seen. I am sure if the possible pitfalls are noted, to which he has called attention, probably the same facts will be demonstrated by others. It seems quite conclusive that the peculiar drop in blood sugar which antedates the convulsions is actually present, as he has so very well shown in his observations.

May I refer to the overdose of glucose. I see no objection to giving an overdose because the sugar is immediately thrown off in the urine and there is nothing to fear from that. This should controvert the claims of those who advise insulin in these cases.

DR. G. D. ROYSTON, ST. LOUIS, MO.—In connection with Dr. Speidel's paper, I want to call to your attention that there are three progressive stages in the vomiting of pregnancy: anorexia, nausea, and vomiting. The time for treatment is most indicated during the first two stages, and these patients should be treated actively, immediately, and vigorously. We give much larger doses of glucose and saline solution than Dr. Speidel mentioned, usually from 500 to 1000 c.c. of 10 or 20 per cent glucose solution intravenously and from 1000 to 1500 c.c. of saline solution subcutaneously, repeated every eight to twelve hours until a real diuresis of more than 1000 c.c. with a specific gravity of 1.010 or less. Following the injection of fluids we feed the patient through an Andrews' nasal tube, kept in place until she is able to retain food. An outline of this method of treatment which was read before the joint meeting of the St. Louis and Chicago Gynecological Societies in Chicago, Nov. 27, 1927, by Drs. Dieckmann and Crossen, was published in the *AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY*, July, 1927.

If these patients do not respond, or become definitely worse after six or seven days of this active and intensive treatment, we would consider abortion, but we have not had to do a therapeutic abortion for toxic vomiting of pregnancy since 1921.

Regarding Dr. Titus' paper, I have recently had a private patient deliver spontaneously very shortly after entering the hospital, following which she had two postpartum convulsions. Her blood pressure was 176/110 and her blood sugar was high, 124, although time did not permit our obtaining any blood for chemical analysis before delivery. There was complete dehydration, marked blurring of vision, diagnosed as due to an optic neuritis, and a very scanty urinary secretion. Following the administration of 1000 c.c. of 20 per cent glucose and 1000 c.c. of normal saline solution under the skin, repeated eight hours later, she became apparently normal in every way forty-eight hours after her attack. There was still slight blurring of vision ten days following the attack, though the eyes showed daily improvement. This case seems interesting in that it happened just at the time that Dr. Titus was presenting his paper. Our associate, Dr. W. J. Dieckmann, has corroborated most of Titus' work, and we feel that the need for glucose cannot be overemphasized.

DR. ROBERT D. MUSSEY, ROCHESTER, MINN.—Mann and Higgins have reported recently the results of an experiment which may aid in future investigations of toxemias of pregnancy. They found that the emptying time of the gall bladder is delayed in most pregnant dogs, guinea pigs, and gophers, while gall bladders of normal animals under the same conditions are emptied in normal time. Following a standard meal of egg yolk and cream, the gall bladder of the nonpregnant animal emptied within four hours while that of the pregnant animal did not empty in some cases for several days.

In order to prove that the delayed emptying time of the gall bladder of pregnant animals was not due to increased intraabdominal pressure, the following scheme was devised. Several paraffin balls, sufficient to equal the size of a full-term pregnancy, were placed in the abdomen of a nonpregnant animal. The abdomen was closed and several days later after the animal had recovered from the operation, it was fed the same type of meal. The gall bladders in these animals emptied in normal time.

While this does not have a direct bearing on the subjects of these papers, it will undoubtedly stimulate further investigation of the toxemias of pregnancy. Is the retardation of the emptying time of the gall bladder in pregnant animals asso-

ciated with lowering or abnormality of certain hepatic functions? Is it a part of lowered or disturbed activity of the gastrointestinal tract?

Dr. Kellogg's observation has been borne out by Artz, of St. Louis, who found lowered gastric acidity in pregnant women. We are all familiar with the fact that there is an arrest of the normal emptying time of the stomach during labor, and this may be evidence of a disturbance in the intestinal tract similar to the retardation of the emptying time of the gall bladder. Further investigation of the emptying time of the gall bladder and action of the smooth muscles in pregnancy may be an important supplement to the clinical observations of Dr. Speidel and of Dr. Titus.

DR. E. L. DORSETT, ST. LOUIS, MO.—In regard to Dr. Speidel's excellent work, I think the majority of us in the past have given too small doses of glucose intravenously. We feel that the initial dose should be much larger than 250 or 300 c.c. intravenously.

With regard to the sudden drops in the blood sugar, that Dr. Titus has so convincingly brought forth, I was wondering if it were possible that this would take place if the patient did not have a convulsion, or, in other words, if we could stop the convulsion, would these sudden drops take place?

We have had 88 cases (all having had convulsions) which we have treated with magnesium sulphate. The results of the first 38 cases, I was delighted with. Our mortality was less than 6 per cent. When we had 60 cases, our mortality went up. When we had had 80 cases, it was a little higher, and then I lost the next three cases. So with 88 cases we have now a mortality of 11 per cent. Even that I think is low, although Williams speaks of 2 per cent and Stroganoff has a much lower mortality but these do not include patients having convulsions.

I believe a very valuable point is the frequent use of glucose. We are prone to give a large dose and then wait for ten or twelve hours before giving another.

DR. WILLARD R. COOKE, GALVESTON, TEXAS.—In a very few cases in which blood-sugar estimations were made, the blood sugar was found to be normal or low. Recently, by accident, two blood analyses were made on one patient, the second specimen being taken just before a convulsion, and it was found that there had been a drop of several milligrams in the blood sugar in the interval of a half hour or so between the taking of the two specimens. We were unable to account for this, and attributed it to error, but it may serve as a corroboration of Doctor Titus' observations.

DR. MILES F. PORTER, FORT WAYNE, IND.—Is there noted any significance in the amount of reaction following the convulsion? That is to say, if the reaction is marked, is that a better sign than when there is a slow reaction? If Dr. Titus' reasoning is correct, it seems to me there should be some significance in the amount of reaction that follows the convulsion.

DR. SPEIDEL (closing).—The essential plea of my paper was to prevent vomiting, as a means of reducing maternal and infant mortality. When it comes to hyperemesis gravidarum, my conception of that condition agrees with that of Dr. Kellogg, that the most important feature of it is an hysterical neurosis and, unless that is controlled, I do not care how much glucose is used you cannot cure the hyperemesis. I challenge any of you to cure a hyperemesis and allow the husband to fondle and pet his wife three times a day, or permit the anxious parents to be in the room.

It is not unusual to find a patient with hyperemesis in the hospital, who has been known to reject even water for a week, and then after perhaps a single injection of glucose and a few doses of bromides to be able to retain fluids. That shows that the hysterical element has been removed, and the patient has returned to normal. My advice is to remove the audience first of all, and you will be

astonished what simple means will restore the equilibrium. I have generally resorted to 10 per cent glucose in those cases. I have not used insulin because the patients that I have treated have responded so well to the simple measures. I never inquire as to whether they vomit or not. I get the report of the vomiting from the nurse's chart.

DR. TITUS (closing).—In response to Dr. Porter's question, I must reply that I do not know whether or not there is any prognostic significance to this reaction which we have observed. I think that he is correct in his surmise, but as yet our investigations do not warrant our drawing any such conclusion.

Dr. Dorsett asked if sudden drops in blood sugar still continue to take place after the convulsions are checked. One of our charts shows three cases studied after cessation of convulsions. The fluctuations were not so wide or so sudden, the waves apparently subsiding slowly after the eclamptic storm. The most interesting of these three patients was the one whose blood sugar fell fairly rapidly at one point, followed by some twitching which made it appear that a convulsion was imminent. The muscular activity of the twitching was sufficient to send the blood sugar to higher and safer levels, and the expected convulsion did not occur.

I would like very briefly to mention some points in connection with Dr. Speidel's paper. I think he generalizes too much in his treatment; that it should be more specific and somewhat simpler. So far as the injection of 10 per cent glucose is concerned, I have been convinced for some time that this is too weak and have come to this conclusion after having conducted a long period of clinical investigation into this subject, during which I have steadily increased both the amount of glucose given and also the strength of the solution. We know that physiologically a patient can utilize one gram of injected glucose per kilo of body weight per hour. We know that the average woman weighs about 60 kilos; she can therefore take up 60 grams in sixty minutes without spill through the urine. Less than 60 grams would be less than a therapeutic dose, and if less than a therapeutic dose is given, it is as unfair to expect the proper effect from the glucose as it would be to give 1/150 of a grain of morphine and then expect the usual effect merely because it is morphine. The more concentrated the solution the more rapid the interchange between blood stream and tissues, and the more rapidly the storage of the sugar occurs in the tissues, as a result of which beneficial therapeutic effects are seen more quickly and are more lasting. I am quite insistent upon the point that 25 per cent solution is the proper strength and greatly preferable to the weaker dilutions.

Referring to the work of Dr. Speidel's associate who is giving continuous injection, the paper which my associates and I have just presented refers to those clinical experiments which show that a serious hypoglycemia with convulsions and prostration may be produced by glucose injections continued over any considerable period of time. This is caused by the out-pouring of excess insulin from the patient's pancreas in response to such an injection and cannot be combated by the usual antidotes.

This confirms the contention that I have always made, that interrupted injections of glucose frequently repeated are preferable to continuous injection. To add insulin to such injections obviously adds an additional element of danger.

Referring again to our own work as presented today, we venture to make the assertion that these findings lift the intravenous administration of glucose solution for pregnancy toxemias out of the situation of being an empiric measure, and that they establish a definite scientific basis for this treatment which had already proved to be valuable.

DR. JAMES R. BLOSS, Huntington, W. Va., read by invitation a paper on the Practice of Ideal Obstetrical Technic in the Home. (For original article see page 424.)

DR. I. W. POTTER, Buffalo, N. Y., read a paper on the **Immediate Repair of Birth Canal Injuries Following Delivery**, With a Lantern Slide Demonstration. (For original article see page 336.)

### DISCUSSION

DR. HERMAN E. HAYD, BUFFALO, N. Y.—These two papers just presented represent two types of modern obstetrics: the one, the ideal for conservatism of the most thoughtful and the most considerate kind; the other representing the dramatic, the surgical. Both have their advantages.

In the hands of you men who are skilled obstetricians, who are skilled surgeons, Potter's work must make an appeal. The general practitioner who is not acquainted with the possibilities of surgical relief certainly should practice the conservative method.

This question was brought most strongly to my mind by one patient whom I sent to Dr. Potter about ten years ago and to whom he brought two babies. The patient had a badly lacerated cervix, areas of cystic degeneration, and had suffered for years from profuse leucorrhea, and menorrhagia; she was a nuisance to me. She was constantly coming to my office for a number of years. I wanted to operate, and she would not listen to it. Finally she became pregnant; I sent her to Potter and he carried out this procedure which he has shown. A most beautiful involution was the result. Whatever will produce involution is the most desirable in obstetric practice. He also carried out the exercises which our President recommends.

As to the operation of Bubis, who has been doing practically the same kind of work, and has extended it to include the repair of cystocele and rectocele. In the first place, the operation on the anterior vaginal wall for cystocele is very difficult and does not always bring about an ideal result, even under the best conditions. Operations on the perineum are not difficult, and if one brings the levator ani muscle together, a good perineum results, but exposing the woman to the possibilities of infection from without at the introitus it seems to me should contraindicate altogether that line of practice; but what Dr. Potter is doing I would commend.

DR. JAMES E. KING, BUFFALO, N. Y.—One feature that has been brought out by this paper, and a feature Dr. Hayd has commented upon, is the great lack of cystocele and anterior vaginal lacerations which we find following Potter's deliveries.

As Dr. Hayd has said, I know of no obstetric birth-canal injury that gives so much difficulty in properly correcting as laceration, or overstretching, of the vesicovaginal fascia, and any method of delivery that lessens the likelihood of such an injury justifies our commendation.

So far as his immediate suture of the cervix is concerned, we should not be surprised that it is coming into prominence at this time. It seems to me rather remarkable that during all these years so little attention has been paid to the freshly lacerated cervix, and I think that we should be pleased that in our day we are giving attention to this important subject.

We must remember that the lacerated perineum of not so many years ago was also disregarded in exactly the same way we have been disregarding the lacerated cervix. In those days the remedy suggested was to bind the limbs together in the hope that it would heal.

DR. D. L. JACKSON, BOSTON, MASS.—I was taught that secondary repair, that is, denuding an area of the mucous membrane of the perineum and sewing it up, could not be accomplished after labor and that, if it was done, the probability of its holding was very slight. I would like to report



that in the last few years I have seen four cases where a complete tear of the perineum was present. Following a subsequent delivery in each of these cases, I denuded and did attempt to get the ends of the sphincter together and to get support from the lateral muscles with a completely satisfactory result in each instance. The only difficulty, I think, to be encountered is due to bleeding from the extensive venous supply.

DR. POTTER (closing).—This work can be done in from three to five minutes, and it does not jeopardize the condition of the patient at all. Perhaps I have made too many of these repairs. In my enthusiasm I have done it routinely. I wanted first to perfect a technic, and I wanted to see the results. I do not think it is open to criticism at all to say that this thing should be done routinely.

DR. LOUIS E. PHANEUF, Boston, Mass., read a paper on **Vaginal Cesarean Section**. (For original article see page 325.)

DR. ROBERT D. MUSSEY, Rochester, Minn., read a paper on the **Classification of Nephritis in Relation to the Prognosis for Pregnancy**. (For original article see page 366.)

DR. WALTER T. DANNREUTHER, New York, N. Y., read a paper entitled **The Prophylaxis of Postoperative Pyelitis**. (For original article see page 406.)

#### DISCUSSION

DR. LOUIS E. PHANEUF, BOSTON, MASS.—Dr. Dannreuther's incidence of pyelitis following operation was much lower than mine. If I reviewed 500 gynecologic cases I would find more than 2.5 per cent. I have felt that plastic operations predispose to this condition, but that is evidently not substantiated by Dr. Dannreuther.

DR. G. D. ROYSTON, St. Louis, Mo.—The phthalein test and blood chemistry have been disappointing at times, and in the final analysis of certain obscure cases we have had to depend almost solely upon the clinical findings. Those conditions that are very definitely nephritic offer no difficulties, but it is the obscure case that is puzzling. At such times we have depended almost solely upon two things: the steadily increasing blood pressure, and the twenty-four-hour output of urine.

DR. F. A. CLELAND, TORONTO, ONT.—I do not know what my incidence of postoperative pyelitis is, but I know that we have not been bothered nearly so much lately as formerly. I think the reason is that we have, to a large extent, developed a prophylaxis as suggested by Dr. Dannreuther.

Even with our public ward cases we conduct our clinics so that we operate only three days a week, and the patients must be in the hospital the day before operation for a clinic to the students. In that way we get the patients in the hospital earlier. We do not allow them to come in at nine or ten o'clock at night for operation the next morning. That is a pernicious habit, and I find it still persists in some hospitals.

We also carry out a postoperative treatment that I think is very beneficial. The nurse is instructed to keep the abdominal patient warm after operation. She must have a large linseed poultice placed over the abdomen; that is done automatically. If the patient requires it, we give her a subcutaneous injection of normal saline solution, but the important instruction is that as soon as the patient can be induced to drink hot water she must do so. If she will take it with soda bicarbonate in the water, well and good. If that is objected to, she must be forced to take hot water.

As far as I am personally concerned, in making my rounds postoperatively, I am very much more interested to see how much urine the patient has excreted than to see whether the bowels have moved. I think that is a very important point in prevention of pyelitis postoperatively.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—May I call attention to a peculiar ability the kidney possesses under stress and strain in its reaction to injury that is perhaps not possessed by any other organ in the body. It is indeed very rare to see kidneys diffusely involved, excepting in very acute conditions. If one will follow cases of acute nephritis through to the end picture, he will be perfectly amazed to find that the picture has changed from a condition in the acute stage of apparent entire involvement of both kidneys to focal degenerative changes; or, if examined in the period before the terminal event, there will be focal inflammatory conditions.

The term focal nephritis is used loosely, and ordinarily one expects to find very definite abscesses in the kidney before he is willing to say it is a classical case of focal nephritis. This is too exacting a requirement, for in many instances no abscesses are formed; only aggregations of lymphocytes are observed.

Just in this connection may I call attention to a biologic feature in connection with the kidney? Richards of Philadelphia, I believe, was one of the first to place our knowledge of the alternating and rhythmic glomerular function upon a very sound scientific basis. He was able to observe positively, and to have others see what he saw; namely, the nephron units of the kidneys actually functioning, and it was a great surprise when he first observed that the units did not act all together or in unison. So one may consider all the two million units or nephrons of the kidney and find that only a certain percentage of the entire group are at work at any one given time. It is logical, then, to assume that similar changes in regard to the ultimate pathologic results; namely, that one part of the kidney will have a different kind of response from other parts, and the parts of the kidney that are definitely weak will be the first to go down under the attacks of acute nephritis, or chronic nephritis, or the repeated nephrites. So the pictures at different periods of life vary so widely that it is a most confusing thing to postulate accurately the end-results.

DR. MUSSEY (closing).—I wish to emphasize the point made by Dr. Royston, that the chemical examinations of the blood which we have at our disposal do not show any changes in the blood in cases of acute nephritis but that in chronic nephritis these examinations are frequently of a great deal of importance.

In the discussion of Dr. Dannreuther's paper, the question was raised of pyelitis following confinement. Medical students of twenty or more years ago were taught that catheterization of the parturient woman was a dangerous procedure. We now know that the pregnant woman and parturient woman may be catheterized under aseptic conditions without danger. Several years ago we catheterized the bladders of 200 consecutive postpartum patients. In each instance, the patient was catheterized after she had voided for the first time or if she did not void within eight hours. In over half the cases, residual urine was found in the bladder after the patient had voided, and the retention was greater in those patients who had difficult instrumental deliveries. In a good many instances, pus was found in the centrifuged specimens. While this observation is now new, it explains some of the cases of fever which occur postpartum and which may be avoided by not allowing residual urine to remain in the bladder.

DR. DANNREUTHER (closing).—Referring to Dr. Pantzer's remarks first, I may say that unfortunately there are no "suspicious" cases. My experience has been that this type of pyelitis develops unexpectedly between the tenth and eighteenth postoperative day. All of us must admit that pyelitis is observed far more often during pregnancy than as a postoperative complication, and I also

venture the assertion that chronic pyelitis is much more common in office practice than is generally supposed, unless cystoscopic investigations are made in all patients with lumbar discomfort or urinary symptoms.

In reply to Dr. Polak's inquiry concerning the care of the bladder in the postoperative period, I can truthfully say that I believe that more cases of cystitis are due to a failure to use the catheter sufficiently often than occur because of its use. I have a standing order that all patients shall be catheterized every six hours for three days, irrespective of voiding, after hysterectomy and after plastic operations (except fistula cases). Residual urine constitutes much more of a menace than does instrumentation. In cases of vesicovaginal or urethrovaginal fistula, I leave a Pezzer retention catheter in the bladder for two weeks, instilling a little weak silver nitrate solution through it daily, and the results have been gratifying. It is advisable to prescribe hexamethylenamin and acid sodium phosphate early in these cases as a prophylactic measure. Hexyl-resorcinol is contraindicated in these cases too, because its use involves the restriction of fluid intake to maintain the surface tension of the urine, which is of course a serious handicap to postoperative patients.

The presence of pus cells in the urine is significant and of diagnostic importance, but I believe that a culture of the urinary sediment is a more reliable index of infection. I desire to emphasize, however, that the discovery of the colon bacillus in the specimens from all six of the patients occurring in my series of 500 cases is no criterion that other microorganisms, such as the staphylococcus and streptococcus, may not cause the same mischief.

A word of warning should be uttered regarding the routine use of bicarbonate of soda. I was formerly so enthusiastic about it, to protect the patient against the precipitation of a postoperative acidosis, that I not only gave the patient this drug for several days before the operation, but also used it in a Murphy drip after operation. A few years ago, however, three postoperative patients at the New York Post-Graduate Hospital died of alkalosis. In two cases alkalis had been used as a matter of routine. The third patient was my own, and the only reason that I escaped responsibility was because she was an emergency case. I had no opportunity to give preliminary therapy and was concerned chiefly with transfusions after operation. She died on the eighth day from alkalosis with an incidental high blood urea nitrogen. Ever since then I have refrained from the use of alkalis as a matter of routine, unless I know what the carbon dioxide combining power of the blood is beforehand.

DR. DAVIS (closing).—There are a number of different hematurias, one caused by turpentine, another from hydrostatic conditions, others from anemic conditions, and some from general vascular disease, especially if it is in the very early or very late periods of life. In an examination of the kidney in hematurias, one finds only a slight bluish-red appearance macroscopically in the kidney, just suggesting a slight degree of passive congestion. Microscopically, it is surprising to find that there is often no structural change. If called upon to make a microscopic diagnosis, one would say the kidney is normal. There is a clinical history of bleeding for months and one feels he must have missed the involved area. I have gone over a number of kidneys of this type to find the bleeding area, but usually without success.

In interstitial nephritis, hemorrhages may take place in various parts of the body, and not infrequently in nasal and gastrointestinal mucosal surfaces. I know of no explanation, excepting that the smaller vessels break and bleed slightly, then close up so that without almost immediate examination the damage in the vessel cannot be recognized.

When patients have died in a few days following rather simple operations, and the anesthetic has not been prolonged, and there has been very little trauma

with but little bleeding at the time of operation, careful examination at the autopsy table will show that these patients have a multiple number of small hemorrhages in different parts of the body, with a marked interstitial type of change in the kidney, liver, pancreas, and heart. Examination of the vascular system will show it is in a degenerative condition.

DR. FOSTER S. KELLOGG, Boston, Mass., read a paper on **Premature Separation of the Normally Implanted Placenta With Special Reference to the Kidney in These Cases.** (For original article see page 357.)

#### DISCUSSION

DR. PAUL TITUS, PITTSBURGH, PA.—One of the most important points brought out by Dr. Kellogg is that increased blood pressure is probably a protective measure. We should be exceedingly cautious about overbleeding the ordinary toxemia patient for fear we might destroy this very protective measure.

There is no question that chronic nephritis has a definite association with these conditions, but is it not likely that chronic nephritis adds merely a general susceptibility rather than that chronic nephritis is always to be found in a toxemia of pregnancy? It is not always associated with it, nor are all of these cases accompanied by even an acute nephritis. That would tend to confirm the idea that the acute nephritis we see so often in toxemia is a secondary matter rather than a primary one.

Dr. Kellogg pointed out in his chart that the blood chemistry of this patient was normal except for a lowered blood sugar. This I would expect and consider an important fact. May I suggest that following intravenous glucose injections, spill of sugar through the urine is not so much dependent upon the height to which this injection sends the blood sugar as it is upon the rapidity with which the glucose injections are given.

Many times accidental separations of the placenta are seen without toxemia and without nephritis. This is a complex problem beyond doubt, and I believe it must be agreed that in one instance we may have a certain set of concomitant clinical symptoms, and in another instance another set. The observation on blood pressure impresses me as one of the most valuable points that Dr. Kellogg has made in this excellent work.

DR. ROBERT D. MUSSEY, ROCHESTER, MINN.—I would like to ask the essayist concerning the presence of edema in the anuric cases. In our waterlogged cases or in those patients with a marked amount of edema and oliguria or anuria, the fluid intake is kept down until the patient begins to excrete more urine. An effort has been made to dislodge the increased retention of sodium chloride in the cell by using either ammonium chloride or ammonium nitrate. Following the intake of ammonium, there is a freeing of sodium chloride which is held in the cell and which is apparently associated with the retention of water. This is usually followed by the free output of urine. Coincident with this, the edema disappears and the patient's condition improves. Then more fluids are given. If edema is not evident, there is no indication for the restriction of fluid intake.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—Something might be said about congenital syphilis as a cause, and about developmental conditions. Where the placenta shows a cord attached eccentrically, the plexus of vessels is inadequate; that is, the plexus will spread out with the trunks attached marginally with the main attachment of the cord. This is a developmental condition that always carries a liability. I believe every placenta should be examined to determine the conditions in the chorion laevic zone, chorion frondosic zone, the cord and its position of attachment, the chorionic and amniotic membranes, and the cotyledons.

The chorion laevis zone may be unusually and relatively thickened, ridged, and broadened so as to diminish the frondosic zone. Extreme eccentric cord attachment is always a hazard for the placental circulation. The fusing of cotyledons and the irregularities in their sizes together with their vascularity are usually indicative of important pathologic changes. The gross examination of the placenta will amply repay for the short time it requires, and it will enable the selection of the most promising sections for microscopic examinations.

DR. KELLOGG (closing).—Having spent the last few months looking at these cases, I feel that I do not know much yet about this phase of the subject, and my only solace is that I do not believe anybody else does.

I purposely avoided the question of etiology in order to make the paper brief and to consider only the kidney group. I am firmly convinced, however, that Dr. Polak's contribution regarding excessive right rotation is a real etiology in some cases. I have cut into two uteri at a single mid-line stroke to try to get a live baby and cut into the cornual end of the left tube. I think there is usually a certain amount of very mild trauma connected with these right rotation cases.

Going back to Dr. Davis' question, we need badly a laboratory devoted to the study of obstetric pathology and a far higher percentage of autopsies.

Regarding Dr. Mussey's question about edema, we have not made the accurate observations that he has made in the study of edema, but we assume that edema fluid is not available as a kidney diuretic. Some of these patients were edematous and some were not. Almost all showed at least a little. We always treat our eclamptic and toxemic patients, whether with premature separation or not, as though they were dry, and our results have been better I think since we have saturated them with fluids. This is a point, it seems to me, often overlooked in treatment; most patients have some fluids, many not enough.

The kidney in relation to separated placenta, to my mind, is almost untouched with a reasonable amount of study. J. Whitridge Williams makes two observations in his textbook about it which has especially interested us. He says, in the first place, that he has seen "so many" cases but only one that was a chronic nephritic. This statement is pretty well in accord with our observations so far as we have gone and can prove; yet we *believe* strongly that further and more intensive study over a period of time will show a group not negligible associated with chronic nephritis. This textbook says that the etiologic factor is presumably of the nature of the etiologic factor in toxemia, but not the same. Ultimately this statement may or may not prove to be true. As evidence against it we have stressed eight cases in which placental separation took place coincident with an actual toxemia of pregnancy. These cases we offer as some evidence that in one group at least the etiologic factor of the two conditions is the same.

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## Books Received

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TEXTBOOK OF PRACTICAL THERAPEUTICS. By Hobart Amory Hare, Professor of Therapeutics, etc., Jefferson Medical College, etc. Twentieth edition, enlarged, thoroughly revised and largely rewritten. Lea and Febiger, Philadelphia, 1927.

GYNECOLOGY FOR NURSES. By Harry Sturgeon Crossen, Professor of Clinical Gynecology, Washington University Medical School, etc. With 365 engravings, including one color plate. St. Louis, C. V. Mosby Company, 1927.

GLASGOW ROYAL MATERNITY AND WOMEN'S HOSPITAL. Medical report for the year 1926. William Hodge and Co., Ltd., Glasgow, 1927.

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## Original Communications

### WHAT THE GYNECOLOGIST SHOULD KNOW ABOUT UROLOGY\*

BY GUY L. HUNNER, M.D., BALTIMORE, MD.

*(From the Gynecological Department of the Johns Hopkins Hospital)*

IN THE past fifteen years I have spent considerable time and energy in calling the attention of the urologist to a few points that he has been overlooking in his special field. Although I cannot boast of a ready and enthusiastic reception for these ideas, I have had sufficient faith in the essential honesty and sportsmanship of the urologist to believe that he would not discriminate against a gynecologist if it could be demonstrated that his theories on urology were workable amongst men who are accustomed to exact results.

This evening I feel quite at home, meeting with those of my own guild and talking on a theme the importance of which is constantly being forced upon me as a gynecologist. Those of you who have been in gynecologic work for a quarter of a century know that great changes have occurred in that time. If we consider but the one symptom of backache, so common in women, we can easily show great progress in our diagnosis and treatment of this condition. As a gynecologist I am sorry to confess that, in far too high a percentage of cases, many of my fellow-workers are still apt to refer this symptom to strictly gynecologic lesions, and that the progress we have made in our interpretation has been largely imposed upon us by workers in other fields, notably by the orthopedist and urologist.

What should the gynecologist know about urology? The close relationships embryologically and anatomically between the genital and the urinary tract not infrequently result in simultaneous disease of both, and too often the signs and symptoms of disease in the one tract are misinterpreted as belonging to the other.

\*Read before the Brooklyn Gynecological Society, March 4, 1927.

NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

In a recent report from the Presbyterian Hospital, in Philadelphia, Laws (Laws, George M.: Ureteral Obstruction in Women, *AM. JOUR. OBST. AND GYNEC.*, 1926, xii, 802) says: "More than 30 per cent of patients who come to a gynecologic service complain of urinary symptoms." Although I have not analyzed statistics bearing on this point, I consider this statement a conservative one.

The older gynecologists present can recall the many instances in which they have performed an extensive gynecologic operation with the utmost confidence that in so doing they would relieve the distressing bladder symptoms which formed one of the patient's chief complaints, only to experience great disappointment in finding that the urologic symptoms persisted.

One thing that the gynecologist should know about urology is that symptoms referable to the urinary tract usually mean disease of that tract. Perhaps the first thing that the gynecologist, as well as the internist and the general surgeon, should remember, in trying to arrive at a diagnosis in cases with obscure abdominal or pelvic symptoms, is that all patients possess a urinary tract.

Since learning of the great frequency of ureteral stricture and of the manifold symptoms and serious ill health for which this lesion may be responsible, I have been amazed at the number of patients who can be restored to reasonably good health by proper treatment. I have also learned that not a few of them had been treated by internists as neurasthenics, or had been submitted to futile treatments for gastroenterologic complaints, or to operations for supposed gall bladder, appendiceal, or genital tract diseases.

The gynecologist, as well as every abdominal and pelvic diagnostician, should recognize as an important fact that serious disease may exist in the urinary tract with but few or absolutely no indications of the trouble from the urinalysis. Failure to grasp this point has been one of the most fertile sources of error in our work of the past.

Elusive ulcer of the bladder, one of the worst of human afflictions, is associated with what is thought to be an apparently normal urine, unless the patient is so unfortunate as to have in addition a stricture of the ureter which has produced a secondary pyelitis with its characteristic urinary picture. Over half of my elusive ulcer patients have ureteral stricture, but fortunately only a few of them have developed pyelitis.

The urine catheterized from the bladder in the elusive ulcer case practically always contains an occasional leucocyte and erythrocyte, but in the past such findings have been ignored as of no pathologic significance and the bladder lesion has been overlooked.

In patients suffering from ureteral stricture I have found hydronephroses with a content as high as 360 c.c., but without a sign of trouble in the urine. Diagnosticians must realize that a trace of

albumin, an occasional cast, an occasional white or red blood cell in the urine usually means some derangement in the urinary tract, and that although these signs may be evanescent and indicate only some temporary disturbance, or be an expression of some recognizable systemic derangement, yet they may indicate a serious and chronic lesion in the urinary tract.

After these introductory remarks, which belong to all who are interested in abdominal or pelvic cases, let us consider briefly a few points which should interest the gynecologist in particular.

*Dysmenorrhea*, one of the most common of all gynecologic complaints, is usually an expression of an obstructive narrowing within the uterus or of inflammatory changes involving the internal genitalia. All gynecologists of experience, however, know that in many cases of dysmenorrhea it is impossible to detect any evidence of inflammatory disease about the genitalia, any malposition of the pelvic organs, any hypoplasia, or any obstructive lesions within the uterus.

If one wishes to know of the complicated views on this subject he needs but to turn to any of our modern textbooks on gynecology to find the many, and sometimes contradictory, theories advanced to account for this troublesome symptom.

All of us have seen curative results in cases of dysmenorrhea from the use of simple common-sense measures—proper diet, exercise, and rest. Such measures are likely to prove effective more particularly in high school girls, who acquire a dysmenorrhea toward the end of the school year, when they are worried over their studies and examinations, and are perhaps indulging in too strenuous athletics and especially in too many night parties. We do not even make a pelvic examination in such cases, for the history points to the probability of an atonic condition of the uterine musculature, resulting in flexion of the fundus on the cervix with temporary stenosis, which is quickly corrected by restoring tone to the general musculature by sane methods of living.

Many of these patients also are cured by one or more of the numerous operations selected after due consideration of the anatomic conditions present. Dilatation and curettage is perhaps the simplest of these operative procedures and the one most frequently used. But in passing I would say that for many years I have warned my students against the use of the curette unless there is some special indication for a microscopic examination of the endometrium. If a curettage is done, a gauze rubber cigarette drain should be left in the canal for four or five days, until the epithelium has had time to cover the raw areas left by the curette; otherwise the last state of the patient is likely to be worse than the first, owing to the formation of multiple stenoses where only one existed before. The judicious use of the stem pessary has been most helpful in some cases. Dudley's discission



operation, Pfannenstiel's excision of the transverse wedge, and the suprapubic operations for the correction of malposition will often prove effectual.

But what I wish to emphasize is that all gynecologists of experience have seen many cases in which these operations, individually and collectively, have utterly failed to give relief.

As gynecologists one thing we should know is that our failure in many of these instances is due to the fact that the dysmenorrhea is due not so much to a gynecologic as to a urologic lesion. In the future in all such cases let us not consign these patients to that favorite medical junk heap—psychoneurosis—until we have first excluded the urinary tract as a possible source of their trouble.

The day of preventive medicine is well upon us, and it is high time that we take stock of our surgery and by careful follow-up records learn how much of it is worse than useless; and then, if possible, substitute some simpler methods that will yield better results.

In the nosography of ureteral stricture in women it is rather characteristic that in its early stages the pain occurs chiefly and often solely at the time of the menstrual period, or during the period of premenstrual congestion. Later on, however, the stricture area becomes so narrow that its effects are felt throughout the month, and are exaggerated by anything that increases the local congestion, such as the menstrual epoch, getting chilled, getting the feet wet, overexertion, or a prolonged rough automobile trip.

Ureteral stricture is a disease of such frequent incidence that it behooves us to bear it in mind in seeking the cause of any case of dysmenorrhea.

Experience soon teaches one so many peculiarities about a dysmenorrhea that depends upon an ureteral stricture that there is rarely any excuse for overlooking it. Essential dysmenorrhea, dysmenorrhea originating from pelvic disorders outside the uterus, or from uterine tumors or misplacements, and dysmenorrhea of urologic origin are all of such common incidence that they are bound to occur in various combinations in a certain number of patients.

When it is quite evident that our patient has an ureteral stricture, which no doubt is contributing to her dysmenorrhea, but we find in addition a gross pelvic lesion, such as a large fibroid, an operation may be advisable as the first line of treatment, but even then it is a great satisfaction to be able to tell the patient about how much or how little she may expect from it as regards relief from her dysmenorrhea.

On the other hand, when it is uncertain how much the genital disorder is contributing to the patient's discomforts, the only rational procedure is to care for this lesion first and await results, knowing that the operation can be done later if necessary.

But how shall we differentiate the various dysmenorrheas? One soon learns to suspect the ureteral origin of a dysmenorrhea simply from the patient's history. When I ask a patient of what she complains and she answers by directing her finger-tips down behind both Poupart's ligaments and says, "I have pains in the ovaries with my menstrual periods," experience has taught me to suspect that she has ureteral stricture. Further points in her history strengthening this lead are as follows: These pains may have come on after a year or more of normal or relatively painless periods, or after childbirth. Or they may have come on before marriage and have not been relieved by childbearing. For some months or years the pain has been monolateral, later becoming bilateral. The pain at first may have been strictly premenstrual and menstrual but gradually it has become continuous, and is exaggerated with the period. The "ovarian" pain is accompanied by backache high in the posterior flanks. This backache was at first a menstrual epoch affair, sometimes beginning before the "ovarian" pain set in but later becoming more or less continuous. There is considerable general soreness and pain over the abdomen, at first occurring at the menstrual epoch, but gradually becoming more or less continuous. There are often associated gastrointestinal symptoms, varying from slight accumulations of gas to severe nausea and vomiting, attacks of diarrhea, or of mucous colitis. In many of these women the pressure of corsets or of an abdominal binder cannot be tolerated. The pain in the back is often worse at night and the patient has found it helpful to sleep with a pillow under the flank or with a flannel blanket over the waistline.

With one or more of the above features there is the additional history of bladder irritation in three-fourths of the stricture cases. This vesical distress may be one of the chief points complained of by the patient, or the bladder history may be elicited only by careful questioning. The patient often says she has no bladder symptoms except, perhaps, "a little frequency at the time of the menstrual period due to the increased nervousness at that time"; or she may answer that her bladder does not bother her except when she is nervous or excited or when she "catches cold" or gets her feet wet.

After obtaining a history with many of the above suggestive features we are put on our guard when proceeding to the physical examination and have no trouble in remembering that the patient has a urinary as well as a genital tract.

The abdominal examination of patients with ureteral stricture almost always reveals tenderness in the kidney regions, and even more often tenderness on pressure over the ureters in the abdominal spindle region (Legge's point), or at the pelvic brim crossing (Morris' point).

If the dysmenorrhea is of ureteral rather than of genital origin, the ureters will be most sensitive to pressure over their course through the

broad ligament, and on palpation in this region the patient often exclaims, "That is my menstrual pain." In cases with bladder symptoms this manipulation also causes the desire to void. If the patient has had rectal pressure or desire for frequent stools, uterine contraction or "after-birth pains," vaginal pressure pains, or pains of obscure origin in the perineum, these are frequently elicited by pressure on the pelvic ureter.

*Ovarian neuralgia* is far too common a diagnosis which has been responsible for the sacrifice of literally thousands of normal ovaries. In not a few cases this diagnosis has been made on the strength of the patient's history and on the fact that the only abnormal physical finding on palpation is an apparently tender ovary. At other times, when some other abnormality is found, especially a malposition, the gynecologist purposes to correct it and at the same time to remove the painful ovary, but at operation the ovary appears so normal that he decides to leave it in its place. Subsequently, however, he regrets his conservatism, because the patient's symptoms persist and the ovary still seems to be the seat of the pain. Now, the explanation for many cases in this category is that the ovary and a tender ureter have both been grasped between the palpating fingers, and if one simply bears in mind the possibility of mistaking ureteral for ovarian tenderness one can easily differentiate the two conditions. In the former case, on bimanual palpation the ureteral region can be avoided and the ovary carried toward the midpelvis and compressed with little or no pain. If now the abdominal hand be left out of action, and the broad ligament portion of the ureter be gently stroked, with the vaginal palpating finger, in ureteral cases the patient will complain of the characteristic pains. If a doubt still exists, the ureter should be tested with the special methods that will reveal stricture if it is present. So far as I know, Howard A. Kelly was the first to emphasize the importance of palpation of the pelvic ureter, and A. M. Judd, of Brooklyn, has repeatedly called our attention to this point.

*Dyspareunia.* Painful coitus is a very common phenomenon. Because of the patient's modesty and our disinclination to ask about this symptom it is often left out of our gynecologic history, although it may be an important factor in the patient's ill health. It is not within the province of this paper to discuss in detail the complicated features of vaginismus and dyspareunia. One can usually elicit from the patient whether her discomforts during coitus are external or internal. If they are external, physical examination usually reveals a cause or the sexual history points to some reason for a psychic repulsion. If the pain is high up or internal, one sometimes finds a painful scar in the cervix, or more often an inflammatory infiltration

of the uterovesical, uterosacral or broad ligaments; or an inflammatory involvement, a tumor, or a displacement of the internal genitalia may be present.

Not infrequently when we have failed to ask the patient about her sexual life, and get to the point in the physical examination of palpating the pelvic ureter, she at once volunteers, "That is the pain I have with the sexual act." Sometimes she leads up to the question on dyspareunia by saying, "That is the pain I have on using a douche nozzle, or when anything touches me there." If she has had bladder symptoms associated with her dyspareunia she often says that the sexual act is followed by a night of unusual bladder frequency and discomfort. If gastrointestinal symptoms, such as gas formation, belching, and abdominal tenderness have been prominent, these are sometimes exaggerated for as long as twenty-four hours after coitus. Not a few patients have given up the sexual life because of painful coitus, which was found later to be due to ureteritis, and one patient said this had led to her divorce. The one point I wish to emphasize here is that as gynecologists you should know that *many cases of serious dyspareunia are of urologic origin*. I am not yet ready to make the statement that dyspareunia is more often dependent on disease of the urinary tract than on disease of the genital tract, but I shall not be surprised if future observation shows this to be true.

By following the diagnostic methods outlined above in the discussion of ovarian neuralgia one can usually determine with a fair degree of certainty whether the dyspareunia is chiefly of ureteral origin, and when in doubt, the therapeutic test is often the deciding factor in the diagnosis.

*Descensus symptoms.* Gynecologists are familiar with the complaint "falling of the womb," or as some patients express it, "My organs feel as if they are coming out."

Such a complaint on the part of a nullipara should at once arouse the suspicion of ureteral stricture. We do see an occasional case of cystocele or of prolapsus uteri in the unmarried and in the nulliparous woman, but they are exceedingly rare and are easily diagnosed on examination. If, however, her distress is caused by highly sensitive ureters, physical examination will fail to show any displacement of the genital organs, and if we have the urinary tract in mind, we can easily elicit the symptoms by pressure over the tender ureters in the broad ligaments.

In some multiparae who complain of the symptoms typical of descensus the prolapsus becomes exaggerated and causes symptoms only after a number of years after childbirth. In such cases the giving way of the pelvic floor has been delayed, and there is frequently a history of sudden strain or trauma, or of prolonged overexertion immediately preceding the final prolapsus.

Our interest here centers on the multiparous patient who comes with such a typical history, but who on physical examination presents a well-preserved pelvic floor and internal genitalia in apparently perfect position. Formerly we were too apt to find an enlarged cervix, or what we thought was slight descensus or an overstretched outlet, and to proceed to operation in the hopes of giving relief. Experience, however, has taught us that many of these patients simply need urologic treatment.

In some cases which are doubtful from the gynecologic viewpoint we can often give perfect relief by using a well fitted pessary. If the pessary test is successful but the patient prefers not to be bothered with wearing and caring for it, we are then justified in operating, but only after we have excluded the presence of ureteritis.

Even in the purely ureteral case the pessary often gives temporary and partial relief by splinting the pelvic tissues and preventing the jarring of the tender ureteral broad ligament regions when the patient is active. However, it will be found in most of the ureteral cases that the relief is only partial and the back aches over the kidney regions, the referred pains in the hips and thighs, the abdominal soreness, and particularly the bladder symptoms persist.

*Menorrhagia.*—We occasionally see a patient complaining of menorrhagia in whom the most careful examination of the genital tract fails to reveal a cause for the excessive bleeding. Such patients often present a definite dyscrasia, the cause being found in their methods of living, or in some serious local or constitutional disease. Ureteral stricture, with its damage to the renal function by obstruction, and the consequent toxemia affecting the mental, nervous, gastrointestinal, and other functions, is one of the most fertile causes of a dyscrasia, and not a few cases of menorrhagia have been relieved by the restoration of the general health through the establishment of adequate renal drainage.

*Urinary Tract Symptoms.*—This discussion of what the gynecologist should know about urology would be far from complete without a brief consideration of purely urologic symptoms. Indeed my early special interest in urologic problems was largely prompted by the oft-repeated question by visitors in Kelly's gynecological clinic: "What do you do for women who are always complaining of bladder symptoms and whose urine shows nothing abnormal?"

The quest for the answer to this problem first led to the discovery of the important rôle played by focal infections in urinary tract complaints. (Hunner: *Chronic Urethritis and Chronic Ureteritis Due to Tonsillitis*, Jour. Am. Med. Assn., 1911, lvi, 1907.)

Twenty-five years ago it was commonly known that in many cases of so-called "neurosis of the bladder" the patients had only a chronic urethritis or a chronic trigonitis. These were then considered to be

sequelae of a past gonorrheal infection, and many patients had their symptoms relieved as if by magic by a few applications of solutions of silver nitrate. Others, however, were not benefited at all, or only partially or temporarily, and because in some the joints were affected and because the salicylates sometimes relieved both the arthritic and the urinary symptoms, we learned to speak of "rheumatic" trigonitis or urethritis as a classification distinct from the gonorrheal variety. We now see more patients with chronic trigonitis and chronic urethritis whose symptoms we relieve by basing our treatment on the focal infection theory rather than on the postgonorrheal origin.

As gynecologists you are probably saying that you can diagnose the gonorrheal cases by the appearances about the urethra and vulva. Unfortunately, this cannot be done, for the red points about the vulvo-vaginal glands formerly supposed to be diagnostic of a previous gonorrhea are often the sequelae of distant focal infections. A cervicitis with leucorrhea may likewise be due to distant foci of infection and logical treatment in such cases includes the removal of the original source.

*Incontinence.*—One urologic symptom in which sooner or later all gynecologists are forced to take an interest is that of urinary incontinence. We cannot enter into an exhaustive discussion of this troublesome symptom, but as gynecologists we should know that many patients have not only urinary frequency but actual incontinence because of pathologic changes in the urinary tract due to distant focal infections.

Of over 250 of my patients complaining of this symptom the incontinence in many has apparently been due to impulses arising in areas of ureteral stricture, and excellent results have been obtained by treating them on this basis.

Enuresis in children, which persists beyond the first decade, is often due to a focal infection causing an inflammatory lesion in the lower ureters, the trigonum, the urethra, or in this entire region. The urine in such cases is usually normal. Removal of the focus even without urologic treatment of the infection results in cure in some cases. In others a few applications of silver nitrate solution to the reddened trigonum, or dilatation of the urethra, with applications of silver nitrate, are followed by relief. In still others the inflammation has involved one or both of the lower ureters and these have to be dilated before a cure is effected.

#### SUMMARY

Gynecologists must bear in mind that ureteral stricture is one of the most common lesions of the abdominopelvic cavity. By virtue of the usual position of the stricture in the lower pelvis and its relations to the pelvic sympathetic nerves, and by virtue of its effects on the

renal function, its symptoms are more varied than those of any local disease with which we are familiar.

It follows that in any obscure train of symptoms involving the abdominal, pelvic, or hip regions, ureteral stricture must always be borne in mind.

The existence of such obscure symptoms together with others referable to the bladder places a special obligation on the diagnostician to investigate the urinary tract most carefully. *The absence of pathologic elements in the urine does not always give the urinary tract a clean bill of health.*

In the case of any patient who, despite one or more pelvic operations still complains of her original symptoms, it is incumbent upon the gynecologist to make a meticulous survey of the urinary tract.

MEDICAL ARTS BUILDING.

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## A REPORT OF FIVE YEARS' ACTIVITIES OF THE MATERNITY SERVICE, SECOND (CORNELL) DIVISION, BELLEVUE HOSPITAL\*

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THE predominant motive in presenting this report is to show that an obstetric service in a general hospital may be conducted with as little loss of life from childbirth as occurs in institutions devoted specifically to maternity work. In order to obtain such results, unusual safeguards against sepsis must be enforced. Nearly 50 per cent of the patients admitted to the Bellevue Hospital obstetric wards have had no prenatal supervision by us, and many of the women have not the simplest notions of antenatal hygiene—in some cases marital relations are continued to the very day of labor. A number of the patients are likewise admitted after attempts at operative delivery by private physicians.

The hospital protects the obstetric service by prohibiting vaginal examinations by ambulance surgeons or admitting officers and by sending to the gynecologic wards all incomplete abortions and all patients admitted more than twenty-four hours postpartum, considering these groups as possibly septic. (In New York State one-third of the fatal septic cases follow abortions.)

In our effort to protect the patients against sepsis, we have conducted normal deliveries without rectal or vaginal examinations, and we make the few vaginal examinations necessary in abnormal cases with antiseptic, as well as aseptic, precautions.

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\*Read at a meeting of the New York Obstetrical Society, October 11, 1927.

Operative intervention has been as conservative as was consistent with the patient's welfare.

This report covers the work of the Second (Cornell) Division at Bellevue Hospital, which has charge of the obstetric wards for six months of each year, from February 1 to August 1. There are two large wards in the main building, which provide beds for sixty adult patients. In addition there is a building two blocks away with an indoor service of fifteen beds and an outdoor service of about thirty cases a month. The midwives reside and are taught in this building. We have, then, an average outdoor service of about 30 patients a month and an indoor service of 147. Practically all of the more serious cases occurring on the wards at the School for Midwives are transferred to the main building.

From 1922 through 1926 there were 4396 indoor deliveries. Seventeen hundred and seventy-two of the patients attended our prenatal clinic, 1527 had no prenatal care, and 982 were given prenatal care by the School for Midwives. In 115 cases the histories were incomplete in regard to prenatal care.

There were 2505 multiparae and 1841 primiparae. The parity in 50 cases was not recorded.

Seventy-three per cent of the presentations were occiput anterior, 14 per cent were occiput posterior, and 5 per cent were breech. There were 10 face presentations, 23 scapular, and 1 compound. In 285 cases the presentations were not recorded.

There were 55 sets of twins and 2 sets of triplets. All of the triplets weighed under 1500 grams and all died.

During the five years, we delivered a total of 5520 patients, 4396 indoor and 1124 outdoor. There were 33 obstetric deaths and 15 deaths from medical or other causes. These have been classified according to the International Code as used by the United States Census Bureau. Two of the obstetric deaths occurred on the outdoor service. Table I and brief individual summaries of these 48 deaths are here given and in addition, I would like to discuss them in groups according to the principal cause of death.

#### MATERNAL MORTALITY—OBSTETRICS

##### *Puerperal Septicemia—8 Deaths:*

A. M. 5/5/22. Para i. At term. Spontaneous delivery. No vaginal or rectal examinations. Temperature from third to tenth day. Three hundred c.c. polyvalent antistreptococcic serum. Wassermann 4-plus.

M. M. 4/11/22. Para iv. At term. Spontaneous delivery. No vaginal or rectal examinations. Intrauterine culture showed *Streptococcus hemolyticus*. One hundred and fifty c.c. antistreptococcic serum. Lobar pneumonia. Temperature from third to sixteenth day.

H. H. 5/9/22. Para i. At term. Spontaneous delivery. No vaginal or rectal examinations. Two hundred c.c. antistreptococcic serum. Temperature from fifth to tenth day. Home A. O. R. on twelve day. Returned few days later to gynecologic ward where she died.

M. F. 2/26/22. Para vi. At term. Delivery by breech extraction on the outdoor service. Transferred to the hospital four days postpartum with a high temperature. Died on the eighth day postpartum.

E. A. 5/22/23. Para iii. Premature delivery at home. Manual removal of the placenta attempted at home by private physician. Admitted four hours postpartum with placenta partially retained. Died of peritonitis on the fourth day.



TABLE I. MATERNAL DEATHS IN 5520 DELIVERIES, 1922-1926

	DEATHS FROM OBSTETRIC CAUSES						DEATHS FROM MEDICAL CAUSES					
	1922	1923	1924	1925	1926	TOTAL	1922	1923	1924	1925	1926	TOTAL
Sepsis	4	1	3	0	0	8		2	2	0	2	8
Premature Separation Placenta	1	3	0	0	0	4	Pneumonia Antepartum	0	0	0	0	1
Placenta Previa	1	0	1	1	1	4	Pneumonia Late Postpartum	0	0	0	1	1
Postpartum Hemorrhage	0	0	0	2	0	2	Cardiac Disease	0	0	0	0	1
Embolus	0	0	1	0	1	2	Epilepsy	1	0	0	0	1
Ruptured Uterus	0	0	1	1	0	2	Tuberculosis	0	0	1	0	1
Eclampsia	6	0	0	1	1	8	Tuberculous Meningitis	2	0	0	0	2
Toxemia	1	1	0	2	0	4	Meningitis	0	0	1	0	1
	13	5	5	6	3	33		5	2	2	3	15

1124 outdoor cases, 2 obstetric deaths or 0.4%

4396 indoor cases, 31 obstetric deaths or 0.7%

5520 in- and outdoor cases, 33 obstetric deaths or .59%

1124 outdoor cases, no medical deaths

4396 indoor cases, 15 medical deaths or 0.27%

C. L. 7/6/24. Para i. At term. Admitted after attempted forceps delivery by private physician. Delivered by high forceps of 4000 gram stillborn child. Died of peritonitis on fourth day.

J. D. 4/15/24. Para i. At term. Admitted thirty-nine hours after labor had started. One rectal examination outside. Spontaneous delivery. Temperature from third to eighteenth day. Pleurisy developed on twelfth day. Death on the eighteenth day. Autopsy: endometritis; general peritonitis; double empyema.

B. B. 4/8/24. Para i. At term. Delivered at home by ambulance surgeon. Admitted with retained placenta. Manual removal. Temperature from first to twenty-sixth day. Blood transfusion on eighth day. Autopsy: acute endometritis; general peritonitis; chronic nephritis.

#### *Eclampsia—8 Deaths:*

T. V. 2/22/22. Para i. Six months pregnant. Admitted in coma after 6 convulsions at home. Had a total of 14 convulsions. Died ten hours after admission, undelivered.

H. P. Para v. Seven months pregnant. On admission B. P. 220/80. Albumin 4-plus with casts. One convulsion. Induction by bag. B. P. dropped 120 points after expulsion of bag twelve hours later. Died at once. Stillborn baby delivered postmortem.

I. S. 5/10/22. Para i. Six months pregnant. Admitted in coma after 4 convulsions at home. Induction by bag. Spontaneous delivery of macerated fetus. Died eighteen hours after delivery.

E. S. 3/24/22. Para iii. Seven months pregnant. Admitted after 3 convulsions at home. Induction by bag. Spontaneous delivery. Had a total of 10 convulsions. Died eighteen hours after delivery.

J. L. 5/30/22. Para vii. Seven and a half months pregnant. Admitted in labor. Albumin 4-plus. B. P. 225/120. Spontaneous delivery of twins. Seven convulsions postpartum. Died six and a half hours after admission.

M. McN. 5/22/22. Para ii. Admitted in coma after delivery of twins at home. Three convulsions before admission. Total of 9 convulsions. Died seventeen hours after admission.

J. A. 2/24/25. Para ii. Nine months pregnant. In coma on admission. B. P. 164/126. Two convulsions. Died eighteen hours after admission, undelivered.

E. R. 4/7/26. Para xiii. Twenty-seven weeks pregnant. Admitted with albumin 4-plus. B. P. 260/150. Had chronic nephritis. Membranes ruptured artificially. Went into coma after 2 convulsions. Died eight and one-half hours later, undelivered. Diagnosis: uremia.

#### *Toxemia of Pregnancy—4 Deaths:*

R. L. 1/13/22. Para i. Nine weeks pregnant. Vomiting of pregnancy. Therapeutic abortion twenty-two days after admission. Died same day. Had symptoms of acute yellow atrophy.

A. D. 3/15/23. Para vii. Six months pregnant. Admitted acutely ill with history of vomiting for three weeks. Sugar by vein. Died undelivered a few hours after admission. Symptoms of acute yellow atrophy.

A. O. 5/7/25. Para i. Thirty weeks pregnant. Wassermann 2-plus. History of vomiting continuously for five days. Spontaneous delivery. Died sixty-four hours postpartum. Symptoms of acute yellow atrophy.

M. R. 5/25/25. Para i. Thirty-eight weeks pregnant. Albumin 4-plus. B. P. 160/110. Induction by bag. Died immediately after anesthesia was started for forceps delivery. Living child delivered postmortem. Autopsy: chronic nephritis; chronic endocarditis; chronic myocarditis.

*Placenta Previa—4 Deaths:*

B. V. H. 5/2/22. Para i. At term. Complete placenta previa. Cesarean section. Temperature from second to tenth day. Embolism of vessels of leg.

M. T. 2/11/24. Para iv. . On outside ward with erysipelas. Profuse bleeding. Induction by bag. Delivery by version and breech extraction. Uterus packed. Temperature from first to fifth day. Peritonitis.

A. N. 4/11/25. Para ix. At term. Bleeding for past month. Induction by bag. Delivery by version and breech extraction. Uterus packed. Hemorrhage behind packing. Death two hours after delivery.

A. L. 6/21/26. Para iii. At term. Central placenta previa. In shock on admission. Hypodermoclysis 1000 c.c. Delivery by version and breech extraction. Uterus packed. Hemorrhage behind packing. Died two and one-half hours after delivery while being transfused.

*Premature Separation of the Placenta—4 Deaths:*

M. G. 3/8/22. Para xv. Seven months pregnant. Admitted in shock. Spontaneous delivery. Transfusion. Died eighth day, apparently of an embolus.

G. T. 3/28/23. Para vi. At term. Induction by bag. Spontaneous delivery. Uterus packed. Profuse hemorrhage through packing. Shock. Died seven hours postpartum. Toxic on admission—B. P. 158/110.

D. A. 5/15/23. Para vi. Toxic—B. P. 220/140. Albumin 3-plus. Had been bleeding nine hours before admission. Induction by bougie and packing, followed by bag. Delivery by version and breech extraction. Shock.

S. B. 7/19/23. Para viii. Seven and one-half months pregnant. Membranes ruptured. Induction by bag. High forceps delivery of stillborn child. Manual removal of placenta. Uterus packed. Shock. Death one hour after delivery. Autopsy: tear of lower uterine segment.

*Intrapartum Hemorrhage—1 Death:*

R. B. 2/25/25. Para ii. At term. Admitted after delivery of first twin at home. Second twin in utero. In shock. Died fifteen minutes after admission, undelivered.

*Postpartum Hemorrhage—1 Death:*

M. G. 2/3/25. Para ii. Thirty-eight weeks pregnant. Admitted in second stage of labor. Spontaneous delivery. No vaginal or rectal examinations. Temperature started to rise after delivery. Sixth day pneumonia. Death on tenth day. Pulmonary embolism.

*Puerperal Embolus—2 Deaths:*

M. B. 2/22/24. Para i. At term. Low forceps delivery. Postpartum hemorrhage. Uterus packed. Pyelitis. Temperature from third to eleventh day, with scarlatinal rash and desquamation. Death on fifteenth day. Embolus and cerebral hemorrhage left temporal lobe of brain.

A. F. 3/28/26. Para i. At term. Attempted forceps delivery by private physician at home. Delivered by high forceps of stillborn child, weighing 4300 grams. Temperature below 100° until sixth day, when patient suddenly died of pulmonary embolus.

*Ruptured Uterus—1 Death:*

M. C. 3/27/25. Para x. At term. Delivered on the outdoor service by version and breech extraction. Admitted in shock three and one-half hours postpartum. Manual removal of placenta. Gum glucose and transfusion. Hysterectomy. Died thirty hours later.

## MATERNAL MORTALITY—MEDICAL

*Antepartum Pneumonia—8 Deaths:*

I. G. 2/8/22. Para i. At term. Admitted with temperature 101.6°. Pulse 120. Intensely cyanotic. Lobar pneumonia. Spontaneous delivery. Death four days later.

A. D. 2/1/22. Para i. At term. Transferred from medical ward with temperature 102.4° and pulse 112. Lobar pneumonia. Spontaneous delivery. Anti body solution 3 times. Died five days postpartum.

C. I. 3/10/23. Para ii. At term. Transferred from medical ward with temperature 102.4° and pulse 100. Lobar pneumonia. Low forceps delivery. Death same day.

C. C. 2/19/23. Para iv. At term. Ill eight days before admission. Bronchopneumonia. Breech extraction without anesthesia. Death five days later of pulmonary edema.

S. L. 4/3/24. Para vii. Thirty-eight weeks pregnant. Admitted with temperature 101°. Mitral stenosis. Spontaneous delivery with no anesthesia. Consolidation of right lower lobe next day. Death two days later.

J. McD. 3/8/24. Para i. Eight and one-half months pregnant. Admitted with temperature 101.6° and pulse 120. Pneumonia and pyelitis. Fourth day blood culture positive for *Staphylococcus hemolyticus*. Low forceps delivery on ninth day. Death next day.

M. H. 6/4/26. Para i. At term. Bronchitis on admission. Mid-forceps delivery L. O. P. One oz. of ether. Consolidation second day postpartum. Death on fifth day of lobar pneumonia.

C. C. 3/23/26. Para iii. Thirty-six weeks pregnant. Admitted with lobar pneumonia. Spontaneous delivery shortly after admission. Death few hours later.

*Postpartum Pneumonia—1 Death:*

F. S. 5/12/24. Para iv. At term. Toxemia of pregnancy and chronic cardiac disease. Spontaneous delivery. Transferred to medical ward on seventh day postpartum and died there of pneumonia.

*Chronic Pulmonary Tuberculosis—1 Death:*

A. R. 1/28/25. Para viii. Thirty-two weeks pregnant. Precipitate delivery four hours after admission. Transfusion. Died on eleventh day postpartum. Chronic pulmonary tuberculosis; secondary anemia; tubercular kidneys; uremia.

*Tuberculous Meningitis—2 Deaths.*

R. L. 2/28/22. Para i. Three months pregnant. Transferred from medical ward with acute vomiting of pregnancy. Seven days later diagnosis made of tuberculous meningitis, and patient was transferred back to medical ward. Died the next day. Autopsy: tubercular kidneys and ureter; tuberculous meningitis.

G. S. 5/16/22. Para v. At term. Induction by bag. Spontaneous delivery. No anesthesia. Death on third day postpartum. General military tuberculosis with meningeal involvement.

*Meningococcus Meningitis—1 Death:*

C. B. 2/22/25. Para vi. At term. History of otitis media for past three weeks. Comatose on admission. Had 6 convulsions. Died same day. Postmortem delivery of stillborn child.

*Chronic Cardiac Disease—1 Death:*

C. K. 3/6/26. Para iii. Twenty-eight weeks pregnant. Admitted with decompensation and acute bronchitis. Pulmonary edema developed two days later. Spontaneous abortion on fourth day. Death ten and one-half hours postpartum. Mitral stenosis and insufficiency.

*Status Epilepticus*—1 Death:

L. N. 3/29/22. Para iii. History of frequent epileptic seizures. Had 14 convulsions. Death sixteen hours after admission, undelivered.

## MATERNAL MORTALITY—OBSTETRIC

*Septicemia*.—Eight patients died of sepsis. Three of these women were delivered spontaneously under our care and *without vaginal or rectal examinations* during labor. Another was admitted after thirty-nine hours of labor, with a history of one rectal examination by a private physician. She delivered spontaneously without further rectal or vaginal examination. One patient was delivered by breech extraction on the outdoor service and was transferred to the gynecologic ward on the fourth day and died there of sepsis. Manual removal of the placenta was necessary in two cases. One of these patients was delivered at home by a private physician who removed the placenta manually; the other was delivered at home by an ambulance surgeon and was admitted to the hospital with a retained placenta which was extracted manually because of bleeding. Another patient was admitted after an unsuccessful attempt at forceps delivery by a private physician and was delivered by us with high forceps.

At the beginning of 1922 we conducted a study<sup>1</sup> of the effects and curative value of polyvalent antistreptococcic serum. It was unfortunate that we were unable to obtain positive blood cultures from these patients who were apparently suffering from a streptococcic infection, as one-half of them had positive cultures from the body of the uterus. In the fourteen cases clinically diagnosed as streptococcemia, there was a mortality of but 15.3 per cent. While the lack of positive blood cultures may fail to convince others of the value of the serum, we are satisfied by the prompt subsidence of the temperature and other symptoms that it is in some instances life-saving and is harmless when properly administered.

Following the reports by Drs. Gellhorn and Rawls, demonstrating the value in gynecologic infections of intramuscular injections of boiled milk, we have used this foreign protein in all cases of postpartum infection which were apparently caused by the staphylococcus, colon bacillus, or saprophytic organisms. These patients all had the symptoms of fever, free foul lochia, parametric tenderness, and exudate. We also used the milk injections in patients showing signs of pyelitis. There is no danger from the injections, provided the patient is tested for the protein and, frequently, after two or three doses the fever and symptoms subside.

*Eclampsia*.—The largest number of deaths occurred from eclampsia and toxemia of pregnancy. Six of the eight eclamptic deaths were in 1922. Labor was induced by bag in three of the patients. Five of the patients were brought to the hospital after convulsions at home. None of them had reached the eighth month of pregnancy.

TABLE II. ECLAMPSIA IN 4396 INDOOR DELIVERIES, 1922-1926

	1922				1923-1926			
	CONSERVATIVE TREATMENT				MODIFIED STROGANOFF TREATMENT			
	NO. OF CASES	MATERNAL DEATHS	INFANT DEATHS	METHOD OF DELIVERY	NO. OF CASES	MATERNAL DEATHS	INFANT DEATHS	METHOD OF DELIVERY
Antepartum	11	4	6	Bag 8	18	2	11	Spontan. 16
Intrapartum	0	0	0	Forceps 2	4	0	2	Bag after recovery 2
Postpartum	4	2	2	Undeliv'd 1	6	0	1	Forceps 4
	15	6 (40%)	8		28	2 (7.1%)	14	
Total Cases 1922-1926, 43.					Maternal Mortality, 18.6%.			

After 1922 we followed the Stroganoff régime for the treatment of eclampsia, varying it only by the elimination of the last two doses of chloral. In Table II great improvement is shown in the results. The patient who died in 1925 was admitted in coma and died eighteen hours later. The 1926 death was undoubtedly one of uremia, but we have included it under the eclamptic deaths because in the last revision of the International Code, puerperal uremia was placed under the diagnostic heading of Puerperal Albuminuria and Convulsions. This patient had had thirteen pregnancies with a history of chronic nephritis in all.

Of the patients who recovered, two were undelivered, and in both instances the child was alive. In these women labor was induced, one a few days after recovery from the convulsions, the other two weeks later.

There were two maternal deaths, or an incidence of 7.1 per cent, in the 28 cases during the last four years. This remarkable drop in the death rate from over 30 to 7 per cent leads to the conclusion that the Stroganoff treatment is preferable to the method formerly employed, that is, induction by bag.

*Toxemia of Early Pregnancy.*—There were 21 cases of pernicious vomiting. One patient had a spontaneous abortion; there were four therapeutic abortions, and 16 patients were cured by dietetic control. One progressed to a condition that we considered as acute yellow atrophy, and her death is recorded under this diagnosis. At the time of death she was eight weeks pregnant, dehydrated and jaundiced, and had been under treatment for two weeks by hypodermoclysis, glucose by rectum, and feeding through a duodenal tube. Finally, with a  $\text{CO}_2$  combining power of 26 per cent, it was felt that the uterus could be safely emptied without the use of anesthesia. The jaundice deepened, and she died the same day. This death occurred in 1922, and at that time we were not giving sugar by vein. There were five other cases of the acute yellow atrophy type of toxemia; two died and three recovered. The patients who died were in the sixth or seventh month of pregnancy. One was admitted after three weeks of vomiting and was acutely ill, but her temperature was  $99.4^\circ \text{F}$ . Fifty grams of sugar in 10 per cent solution were given by vein; this was followed by a chill and a rise of temperature to  $107.4^\circ$ , with delirium. She died three and a half hours after receiving the glucose. This death occurred in 1923, and there is no doubt that the glucose was given too rapidly. The other patient had been vomiting at home for five days and was admitted in labor. She delivered spontaneously a 1700 gram baby. The patient was dyspneic and in very poor condition and died on the third day postpartum.

The first of the three patients who recovered was three months pregnant and had been operated upon for appendicitis. When the

vomiting continued and jaundice appeared, it was realized that there was a liver disturbance. On the second day postoperative she was transferred to us and given hypodermoclysis and sugar by vein. This was repeated on the following day, and the  $\text{CO}_2$  rose to 64 per cent, although there was still a considerable amount of acetone in the urine. Three days later she aborted spontaneously. Her condition improved steadily, although the urine contained much bile. The second patient had black vomit for five days. Labor was induced by bag and she delivered a 2250 gram stillborn child. Hypodermoclysis was given and also fifty grams of sugar by vein. The vomiting ceased after the delivery. On admission the N.P.N. was 63;  $\text{CO}_2$ , 30. Nine days later the N.P.N. was 24;  $\text{CO}_2$ , 58. In the third case the patient had had black vomiting and tenderness over the liver for two days, and had been suffering from marked obstipation. Labor was induced by a bag, and she delivered a 2600 gram living baby. This patient also was given saline solution by hypodermoclysis but no sugar. Recovery promptly followed delivery.

*Chronic Nephritis.*—There were 36 cases of chronic nephritis that required treatment for the condition. Labor was induced in eight cases by bagging and in two by rupture of the membranes. One patient was delivered by vaginal hysterotomy. The remaining 25 went into labor spontaneously after the administration of castor oil and quinine. Twenty-seven of these patients had a systolic blood pressure ranging over 150 and nine over 200. In all instances the albumin in the urine was from 2- to 4-plus. One woman who had had a prolonged labor died just after the anesthesia was started for a forceps delivery. Sixteen of the 36 babies died; 8 were abortions, and 5 were macerated fetuses.

*Preeclampsia.*—There were 87 cases of preeclampsia. All of them had albuminuria, and most of them had a rise in blood pressure. Labor occurred spontaneously in 63 cases. Twenty-one of the 63 babies were stillborn or died shortly after birth; 6 were macerated fetuses, and 7 were abortions.

Labor was induced in 15 cases. Six of the babies were dead at birth—2 were abortions and 4 were macerated. Nine of the women went into labor spontaneously but were delivered by operative procedures. In this group one baby was stillborn. The total infant death rate of preeclamptic mothers was, then, including abortions and macerated fetuses, 32 per cent, but it should be noted that many of the babies were premature.

In addition to the 87 cases of preeclampsia there were 30 cases of toxemia of pregnancy accompanying premature separation of the placenta. These have been considered under the latter heading and are not included here.



*Placenta Previa.*—We had 58 cases of placenta previa—26 central, 11 partial, and 21 marginal—with four maternal deaths or a rate of 6.9 per cent. One of these women, however, had erysipelas before delivery. Twenty-eight of the babies died, and of these 6 were abortions, giving an infant death rate of 48.2 per cent.

Twenty-nine of the patients were induced by the extraovular insertion of a Voorhees bag, and we believe that our good results are largely due to the fact that the routine treatment requires the operator who inserts the bag to remain with the patient until she is delivered and out of shock. Four spontaneous deliveries, 1 forceps delivery, and 24 breech extractions followed the bagging. Four women were delivered by abdominal cesarean section and 2, in early pregnancy, by vaginal hysterotomy. One of the patients who had an abdominal cesarean section operation died; this was the only death from cesarean section during the five years.

TABLE III. PLACENTA PREVIA IN 4396 DELIVERIES, 1922-1926

METHOD OF DELIVERY	NUMBER OF CASES	MATERNAL DEATHS	INFANT DEATHS	REMARKS
Cesarean	6	1	4	2 vaginal hysterotomies, 5½ months
Bag	29	2	10	22 versions & extractions 2 breech extractions 1 forceps. 4 spontaneous
Version & Extraction	10	1	5	9 4-fingers dilated on admission
Ruptured Membranes	4	0	3	1 Braxton-Hicks All marginal
Forceps	2	0	2	Dilated on admission
Spontaneous	7	0	2	All marginal. Moderate bleeding
	58	4*	28†	*1 case of erysipelas antepartum †6 were abortions

Maternal Mortality 6.9%  
Infant Mortality 48.2%

Central placenta previa 26  
Partial placenta previa 11  
Marginal placenta previa 21

The great difficulty with abdominal section in placenta previa lies in the fact that the majority of serious cases, that is, the central and partial types, are likely to be more or less exsanguinated on admission, and operative procedure so increases the prostration and shock that recovery is problematical. The one cesarean death in our series was from uterine sepsis, a complication that is always to be anticipated in patients who are brought in after they have been examined through an unprepared vulva. Eleven, or one-half, of the women with marginal placenta previa were delivered spontaneously, following rupture of the membranes.

We instituted no operative procedure in the hemorrhage cases while shock existed, contenting ourselves with the treatment of this condition and the prevention of further blood loss. In every case of par-

tial or complete placenta previa, the uterus was packed following delivery. Two of the four deaths were due to postpartum hemorrhage that occurred behind the packing.

*Premature Separation of the Placenta.*—There were 67 cases of premature separation of the placenta, 35 occurring before the eighth month of gestation. In all, four women died, a mortality of 5.9 per cent. Two of the patients who died lapsed into shock immediately following delivery which was spontaneous in one instance and by version in the other. It has seemed to us that the shock might have been due to splanchnic dilatation due to lowered intraabdominal pressure, because in one case there was an immediate drop in blood pressure from 220 to a point at which it could not be ascertained. Another woman was admitted in shock; she improved following a transfusion but died on the eighth day of an embolus. The fourth woman died from trauma during delivery by high forceps. The autopsy showed a small tear in the lower uterine segment but no involvement of the large vessels.

There were 43 infant deaths including 15 abortions, giving a mortality of 64 per cent.

TABLE IV. PREMATURE SEPARATION OF THE PLACENTA IN 4396 INDOOR DELIVERIES, 1922-1926

AMOUNT OF HEMORRHAGE	NO. OF CASES	TOXEMIA	PACKING	SHOCK	MATERNAL DEATHS	INFANT DEATHS	REMARKS
Severe 2000 c.c.	22	9	10	14	4	21	Bag, 10 Membranes rup- tured, 5 Version, 2 Cesarean, 1 Spontaneous, 3
Moderate 1500 c.c.	16	7	1	0	0	10	Bag, 3 Forceps, 1 Cesarean, 1 Memb. rupt. & version, 2 Memb. rupt. & spont., 1 Spontaneous, 8
Slight 1000 c.c.	29	13	0	0	0	12	Bag, 3 Forceps, 1 Memb. rupt., 3 Spontaneous, 22
	67	29	11	14	4	43*	*15 were abor- tions

Maternal Mortality, 5.9%; Infant Mortality, 64%.

We have divided the cases of premature separation of the placenta into three groups according to the amount of hemorrhage—the serious, with hemorrhage estimated as more than 1500 c.c.; the moderate, with hemorrhage of from 1000 to 1500 c.c.; the slight, with hemorrhage of approximately 1000 c.c. Any bleeding estimated as less than

1000 c.c. was not considered as a hemorrhage. All of the maternal deaths and half of the infant deaths were in the severe group, giving for this type of hemorrhage a maternal mortality of 18.1 per cent and an infant mortality of 95.4 per cent. As indicative of the extent of the bleeding, it is interesting to note that 14 of the 22 serious cases went into shock. Five of them, in addition to hypodermoclysis, etc., were given a transfusion. There were 16 cases of moderate hemorrhage, with no maternal or infant deaths. None of these patients showed symptoms of shock before delivery. In the 29 cases with slight bleeding there were no instances of shock and no maternal deaths. Twelve, or 41 per cent, of the babies died.

Thirty-three or about one-half of the patients delivered spontaneously. Toxemia, as evidenced by a rise in blood pressure and albumin in the urine, was noted in 29. As we were observing particularly the incidence of toxemia, we were careful to have definite signs before we credited the premature separation of the placenta with this complication or origin.

Patients who, on admission, are noninfected and have a dilated or dilatable cervix should be delivered from below, unless the blood pressure is 200 or over. In this case it is better to do a cesarean section because of the high incidence of shock that follows the lowering in intraabdominal pressure after rapid delivery from below. When, however, the delivery occurs through the natural channels, a Beck binder should be tightened as the child is extruded or a sand-bag should be placed on the abdomen.

*Postpartum Bleeding.*—There were 66 cases of postpartum hemorrhage which we have divided into two groups, those with serious and those with moderate hemorrhage.

Each of the groups has been subdivided according to whether the hemorrhage occurred before or after the removal of the placenta. It was necessary to pack the uterus in 25 of the 66 cases. The packing—iodoform gauze—was inserted through a tube packer and removed within twenty-four hours. Sixteen of the patients were delivered by operative procedures. The placenta was manually removed in 29 cases. Twenty-four of the patients developed shock.

Five, or 7.5 per cent, of the mothers died. Two patients in whom the placenta had been removed manually died of sepsis. A third patient died of cerebral embolus. A fourth was admitted in a dying condition and died in fifteen minutes. The fifth died on the tenth day, of bronchopneumonia. She had been delivered spontaneously and had had only a moderate hemorrhage. We have listed this case here because we felt that the pneumonia was caused by numerous small emboli that formed immediately after the hemorrhage.

*Shock.*—As death follows the advent of shock in many hemorrhage cases, we made a study<sup>2</sup> of the action of gum glucose in obstetric

TABLE V. 66 CASES OF POSTPARTUM HEMORRHAGE IN 4396 DELIVERIES, 1922-1926

	SEVERE HEMORRHAGE									MODERATE HEMORRHAGE									
	DELIVERY				PLACENTA					NO. OF CASES	DELIVERY				PLACENTA				
	NO. OF CASES	SPONT.	OPERAT.	AT HOME	MAN. REM.	CHLOR.	PACKING	SHOCK	MAN. DEATHS			SPONT.	OPERAT.	AT HOME	MAN. REM.	CHLOR.	PACKING	SHOCK	MAN. DEATHS
Intrapartum*	21	9	5	7	15	5	11	8	15	18	13	3	3	13	5	3	4	1	
Postpartum	17	5	6	6	1	14	10	11	1	10	7	3	0	0	10	1	1	1	
	38	14	11	13	16	19	21	19	3	28	20	5	3	13	15	4	5	2	

\*After delivery of baby and before delivery of placenta. Maternal Mortality, 7.5%.

shock. This followed the demonstration by Dr. Lillian K. P. Farrar of the value of gum glucose as a prophylactic against shock in gynecologic operations.

We have a group of professional donors for transfusion purposes, but because of the time that must elapse, especially at night, before a donor can be secured, we use gum glucose infusions as a temporary substitute for transfusion. In a number of cases the patient was brought out of shock by this method, and the blood pressure raised to a point where operation was possible. We believe that provided gum glucose is given slowly enough, that is, not faster than 4 c.c. per minute and at a temperature of 104 degrees, it is harmless and of great value in raising the blood pressure. When there has been hemorrhage, transfusion should follow.

*Rupture of the Uterus.*—We had one death from rupture of the uterus. The patient was delivered on the outdoor service by version following an attempt at forceps delivery. We do not believe in delivery by version following an unsuccessful attempt by forceps, as it is the common cause of rupture of the uterus. The patient was transferred to the hospital and given gum glucose by vein and a transfusion. After the blood pressure had risen to a point over 100, a hysterectomy was performed. Death occurred on the third day.

Another patient who had a spontaneous rupture of the uterus recovered after hysterectomy.

A third patient, with a tear of the lower uterine segment that occurred during an operative delivery, has been listed under her original condition, accidental hemorrhage.

#### MATERNAL MORTALITY—MEDICAL

*Medical Complications.*—The cases with medical complications explain themselves. The large number of patients who died of antepartum pneumonia had the grippe-pneumonia type of the disease, common during the winter months, and in every instance the patients were admitted with evidences of lung involvement. Through consultations, the treatment of these patients was conducted under the supervision of our medical service.

#### INFANT MORTALITY

*Mortality on the Indoor Service.*—We have divided the infant deaths into two groups: first, viable infants 1500 grams and over in weight, and second, those under 1500 grams, which we consider abortions and nonviable. There may be instances when the child under 1500 grams is viable and will live even to adult life, but they are very few. In the 4396 indoor deliveries there were 137 abortions and 315 premature babies, that is, babies between 1500 and 2500 grams. In this latter group there were 85 stillbirths and neonatal deaths, a rate of 27.3 per

TABLE VI. INFANT DEATHS IN 4396 INDOOR DELIVERIES, 1922-1926

CAUSE	INFANT DEATHS		CAUSE	ABORTIONS UNDER 1500 GRAMS
	STILLBIRTHS	NEONATAL		
Cesarean	4	3	Antepartum Bleeding	25
Forceps	30	8	Syphilis	19
Version & Extraction	24	3	Toxemia	36
Craniotomy	7	0	Tuberculosis	3
Antepartum Bleeding	24	12	Acute Infection of Mother	5
Difficult Labor	7	3	Unknown	49
Prolapsed Part	9	2		
Monstrosity	6	3		
Toxemia	29	12		
Syphilis	13	5		
Spontaneous Delivery				
Miscellaneous	33	25		
	195	74		137
	(Mac. 57)			(Mac. 47)

Stillbirths and neonatal deaths including abortions:	406 - 9.2%
Stillbirths and neonatal deaths without abortions:	269 - 6.1%
Stillbirths and neonatal deaths without abortions and macerated:	212 - 4.8%

cent. This high rate, of course, markedly affects our general rate and is due largely to the deaths of infants whose mothers had toxemia, placenta previa, and accidental hemorrhage.

Toxemia stands foremost as the cause of stillbirths and, including abortions, accounts for 19 per cent of the deaths. Antepartum bleeding stands second with a rate of 15 per cent. Forceps and version deliveries stand third. There were 9 monstrosities.

Thirty-seven, or 9.1 per cent, of the deaths were attributed to syphilis as the primary cause, but the total death rate of children of syphilitic mothers was 13 per cent.

In the 406 deaths, 104, or about 25 per cent, were macerated fetuses. This point is important, as most of the mothers in these cases had had no prenatal care. If we deduct the macerated fetuses and abortions, in other words include in the death rate only those infants for whom we might be considered responsible, the death rate is 4.8 per cent. The total death rate, including all stillbirths and neonatal deaths is 9.2 per cent.

*Mortality on the Outdoor Service.*—The infant death rate on this service is very low, but this was to be expected as the mothers were all normal multiparae. There were 23 stillbirths 10 of which were macerated, and 11 neonatal deaths 2 of which were abortions—a total loss of 34 infants or 3 per cent.

#### MATERNAL MORBIDITY

*Morbidity on the Indoor Service.*—Patients with temperature of 100.4° for two consecutive days (excluding the first day) during the postpartum period have been included in this group. We have found the morbidity rate slightly higher than was expected in view of the fact that 58 per cent of the indoor deliveries were conducted without

TABLE VII. ANALYSIS OF MORBIDITY IN 4348\* INDOOR DELIVERIES, 1922-1926

YEAR	OBSTETRIC MORBIDITY			MEDICAL AND OTHER MORBIDITY				
	NO VAGINAL OR RECTAL EXAM. 2562 CASES	VAGINAL EXAM. 952 CASES	OPERATIVE 735 CASES	MASTITIS	PYELITIS	RESPIRATORY DISEASES	TUBERCULOSIS	MISC.
1922	52	13	38	5	1	6	4	7
1923	21	5	32	6	2	6	2	1
1924	40	31	38	1	9	20	1	1
1925	29	8	20	2	3	2	2	4
1926	45	9	32	3	1	4	4	2
	187	63	160	17	16	38	13	15

\*No fatal cases in this group. Mortality considered separately.  
Total Uterine Morbidity, 9.6%; Uterine Morbidity over 3 days, 5.9%.

vaginal or rectal examinations. We have divided the cases with morbidity into two groups—those with temperature due to uterine infection and those with temperature due to medical or surgical causes. The total uterine or obstetric morbidity was 9.6 per cent.

Comparison of the temperature in patients who were examined vaginally or rectally with those who were not show that in the former group the rate was 6.6 per cent and in the latter 7.2 per cent—a difference of 0.6 per cent. The slightly lower rate in the cases that were examined is explained by the fact that during the past year we have been using vaginal injections of 2 per cent mercurochrome as a routine procedure before examination. Vaginal injections of 2 per cent mercurochrome have also been made in all operative cases. We have used mercurochrome injections more and more frequently since Mayes' report before this Society in 1925. There was a morbidity rate of 21.7 per cent in the operative cases.

Of the 410 cases with obstetric morbidity, 44, or 1 per cent, of the 4396 indoor deliveries, had a temperature for ten days or more. Fourteen of the 44 were in the operative group. Special mention must be made of one patient who lost both legs—one, half way to the knee and the other at the ankle. This woman, a primipara, was delivered by low forceps, as the head had been on the perineum for some time. Her temperature gradually rose to 103° on the seventh day, and at this time she complained of cold and numbness in both feet. She was transferred to the surgical service, and three days later there was a well-recognized demarcation line of the right foot and left leg up to a point just above the ankle. The left leg was amputated six days after the first signs of thrombosis were discovered and the right foot on the nineteenth day. The patient had a stormy convalescence but finally recovered.

In the group of cases with morbidity attributable to nonobstetric causes, there were 17 cases of mastitis. Most of these did not have abscess formation; the temperature subsided after compression or the application of an ice-bag. There were 16 cases of pyelitis with a temperature for two days or more. In addition, there was active pyelitis in one woman who died of sepsis and in another who died of pneumonia. In the latter case there was a positive blood culture of staphylococcus before delivery. Five patients with pyelitis showed no rise in temperature, and sixteen were discharged antepartum or admitted postpartum and therefore are not recorded in the table.

*Morbidity on the Outdoor Service.*—Twenty-three of the 1124 outdoor patients had morbidity in the postpartum period. Any of the outdoor cases that showed marked abnormality were transferred by ambulance to the hospital, and therefore there was very little operative procedure.



## INFANT MORBIDITY

In 1922 we had an epidemic of contagious impetigo. Notwithstanding changes in the wards and nurses and especial care on the part of the staff, we had 224 cases in six months. Only the first three babies died, and these infants had exfoliative dermatitis with loss of skin over large areas. The disease became steadily less severe but persisted for several months. A special study of this infection was made by one of the staff.<sup>3</sup>

We had, during the five years, no severe infections of the umbilical cord. As soon as the cord is cut, it is wiped with tincture of iodine, and a dry sterile dressing is applied.

We treated the infants who showed any symptoms of head injuries with subcutaneous injections of maternal blood and kept them quiet, not allowing them to be moved even for nursing.

The babies who required additional feedings were given the Holt-Howland formula, known as 5 and 20. Very premature infants were fed breast milk from foster mothers and kept in incubators.

One of our staff, Dr. Gravelle,<sup>4</sup> modified an open incubator box that we had used for fifteen years by constructing a double wall with an electrical appliance that automatically keeps the temperature at 100° F. The infant lies with its head outside the box.

## THE CONDUCT OF NORMAL LABOR

We discarded the vaginal examinations in 1921 because of the increase in sepsis that occurred, not only in our hospital but in hospitals throughout the country. We believe that the rectal examination is quite as likely as the vaginal to carry infection to the upper part of the vaginal tract, and therefore, since 1922 we have conducted normal labors with the abdominal examination alone. We wish to confirm the demonstrations of the German clinics where it was shown that a surprising amount of information can be obtained from an abdominal examination. After a few months' practice with this technique, as much information can be acquired as with the vaginal or rectal examination. Even the amount of dilatation may sometimes be ascertained by abdominal examination. We have used this method of conducting labor conservatively, and if the uterine contractions are prolonged over twelve hours without advance of the head or if there is evidence of trouble not fully recognized by abdominal palpation or if the woman is corpulent and the information acquired is not adequate, we make the additional vaginal examination. We regularly check our abdominal findings by observing the restitution and rotation of the head as it is born through the vulva, and we have found that there is about 80 per cent of accuracy even in the examinations of the junior internes.

In making the abdominal examination we try first to map out the fetal back. We then determine in the head positions the side to which the occiput presents. We palpate the upper and the lower poles of the fetus by deep lateral palpation of the abdomen. This almost invariably determines the extent of flexion of the presenting head. Brow and face presentations may be ascertained in a like manner. The amount of engagement may be accurately learned by the Pawlik grip by which, with the thumb on one side and the four fingers on the other, the fetal head may be grasped through the abdominal wall. As labor advances, the dilatation can be determined by the rise of the contraction ring. When this ring is four-fingers' breadth above the symphysis, the cervix will be found to be almost fully dilated. As a rule, further definition cannot be obtained by this examination. When operative delivery becomes necessary, it can be performed on a clean case or at least on one that has not been infected by the attendants.

During the five years we have conducted 58 per cent of the labors on the indoor service in this way and in the last year, 72 per cent. On the outdoor service, last year, 195 labors were conducted with 52 vaginal examinations. The chief difficulty that we have to overcome is the objection on the part of the internes and students to the substitution of the abdominal for the vaginal examination. They feel that part of their training is being withheld, and therefore each new staff must be convinced through observation and experience.

#### OPERATIVE PROCEDURES

*Cesarean Section.*—We have had 93 cesarean sections in the five years. Sixty-six were of the low cervical type; 19 of them were elective because of previous section, and 47 patients had labors that averaged twenty-three hours. In most instances these patients were admitted after some hours of labor at home, and many of them had had vaginal examinations so that the morbidity was high, but there were no maternal deaths.

There were two vaginal hysterotomies for placenta previa in the fifth month and one for chronic nephritis.

It will be noted that there were 21 operations where the incision was low, but the bladder was not retracted. This operation was done

TABLE VIII. CESAREAN SECTIONS IN 4396 INDOOR DELIVERIES, 1922-1926

	NUMBER OF CASES	PRIMARY UNION	STITCH ABSCESS	WOUND INFECTION	MORBIDITY	MATERNAL DEATHS	INFANT DEATHS
Low Flap*	66	49	12	5	34	0	4
Low Uterine	21	15	1	1	1	1	5
Mid Uterine	3	2	1	0	1	0	0
Vaginal Hysterot- omy	3	3	0	0	0	0	3
	93	72	14	6	36	1	12

\*47 low Flap with average labor of 23 hours.

Maternal Mortality 1.07%  
Gross Infant Mortality 12.9%  
Net Infant Mortality 8.6%

TABLE IX. 419 CASES OF CONTRACTED Pelves IN 4396 INDOOR DELIVERIES, 1922-1926

	TOTAL NUMBER OF CASES	SPONT. DELIVERIES		OPERATIVE DELIVERIES						INFANT DEATHS
		NUMBER	INFANT DEATHS	TOTAL	CESAREANS	FORCEPS	VERSIONS	CRANIOTOMIES		
Generally Contracted	173	115	5	58	31	22	3	2	8	
	210	134	3	76	30	39*	6	1	7	
	33	19	1	14	4	9	1	0	1	
	3	0	0	3	2	1	0	0	1	
	419	268	9	151	67	71	10	3	17	

\*1 maternal death from sepsis.

rather than the low cervical because of previous sections or overhanging and corpulent abdomens. The only death that occurred from cesarean section was that of a patient with placenta previa who was delivered with a low uterine section.

*Pelvic Contraction.*—We felt that the apparent safety with which the low cervical cesarean section can be done late in labor justified trial labor in the treatment of patients with relatively contracted pelvis. There were 419 cases of pelvic contraction. Two hundred and sixty-eight delivered spontaneously after trial labors; 151, or 37 per cent, were delivered by operative procedures, 67 of which were cesarean sections.

The only patient in the series who died was delivered by a median forceps operation. Death was caused by septic thrombus of the brain. There were 26 infant deaths or, deducting 4 deaths due to maceration, 2 to hydrocephalus, and 1 to erysipelas, a net loss of 19, or 4.5 per cent. A report<sup>5</sup> of our cases of pelvic contraction has already been published.

TABLE X. FORCEPS DELIVERIES IN 4396 INDOOR DELIVERIES, 1922-1926

	NO. OF CASES	INFANT DEATHS	MATERNAL DEATHS	REMARKS ON MATERNAL MORTALITY
High Forceps	71	23	4	1 premature separation of placenta 1 sepsis 1 chronic nephritis & cardiac disease
Mid Forceps	180	17	2	1 pulmonary embolus 1 antepartum pneumonia
Low Forceps	179	13	2	1 antepartum pyelitis & sepsis 1 antepartum pneumonia 1 antepartum pneumonia & pyelitis
	430	53 (6 mac.)	8	

Net Infant Mortality, 10.9%.

*Forceps Deliveries.*—The number of our forceps deliveries—430—seems large, but in many of the cases the forceps procedure consisted merely in lifting the head over the perineum, the so-called forceps control, a procedure that we believe to be a conservative operation.

One hundred and forty-four of the forceps deliveries were necessitated by occiput posterior positions. Forty-one of these were high forceps operations performed after an average of thirty-five hours of labor with engagement of the fetal head. One mother who, before admission, had had prolonged attempts at forceps delivery by a private physician, died of sepsis. Eight babies died. There were 67 mid-forceps deliveries after an average of twenty-four hours of labor. Three of these infants died. Thirty-six patients were delivered by low forceps, with 4 infant deaths. The total stillbirth and neonatal death rate in the occiput posterior cases was 10 per cent. The Williamson<sup>6</sup> operation, that is, the application of the forceps to the head in a transverse position, is the one that we regularly use. There

is no danger in this procedure provided the cervix is retracted over the head and no traction is made until after rotation occurs as the forceps is locked.

In the 430 forceps deliveries one woman died from sepsis and one from embolus. There were 6 other maternal deaths from complicating conditions for which the forceps procedure was done: one from cardiac disease, 3 from antepartum pneumonia, and one from premature separation of the placenta. A total of 53 infants died. Six were macerated fetuses, and deducting these, the infant mortality rate was 10.9 per cent. The obstetric morbidity was 16.6 per cent.

*Breech Extraction.*—Breech extraction was performed in 227 cases of spontaneous breech presentation. One of the patients died of eclampsia and one of antepartum pneumonia. There were 71 stillbirths and neonatal deaths or, deducting 18 macerated fetuses and 18 abortions, a net total of 35 deaths, or 15.4 per cent.

TABLE XI. BREECH DELIVERIES IN 4396 INDOOR DELIVERIES, 1922-1926

METHOD OF DELIVERY	NUMBER OF CASES	INFANT DEATHS	MATERNAL DEATHS	REMARKS
Breech Extraction	227	71 (18 mac.) (18 abor.)	2	1 eclampsia 1 antepartum meningitis
Version & Extraction	77	33 (2 mac.) (1 abor.)	3	1 antepartum pneumonia 2 placenta previa

Breech Extraction—net infant mortality, 15.4%; Version—net infant mortality, 38.9%.

Indication for versions: Placenta previa, 30; Prolapsed part, 20; Transverse, 4; Premature separation placenta, 5.

*Version and Breech Extraction.*—Seventy-seven patients were delivered by version and breech extraction. Thirty of these operations were done for placenta previa, 20 for prolapsed parts, 4 for transverse positions, and 5 for accidental hemorrhage.

There were three maternal deaths, two from placenta previa and one from antepartum meningitis. There were 33 infant deaths, including 2 macerated fetuses and 1 abortion; deducting these, the net infant death rate was 38.9 per cent. While the infant mortality seems high, it may be noted that the majority of the babies were premature.

In all cases of placenta previa, external version to bring down the breech was attempted before the administration of anesthesia; if not successful it was done after the anesthesia was complete. This procedure is very easy in patients with complete placenta previa, because the presenting part is not in the pelvis.

*Induction.*—Labor was induced in 103 cases (excluding 4 therapeutic abortions), in 85 by bag, in 8 by rupture of the membranes, in 9 by partial manual dilatation, and in 1 by bougie. The infant mortality in the cases that were induced by bag was 50 per cent. This high rate is due to the complications for which the induction was

done: in 32 cases of toxemia, eclampsia, and chronic nephritis there were 18 infant deaths, and in 45 bleeding cases there were 21 infant deaths.

The number of cases induced by rupture of the membranes, manual dilatation, or bougie are too few to be used for purposes of comparison. In all instances the indication was some form of toxemia or of bleeding. Thirteen infants died, making the total infant death rate in the 103 induced cases 54 per cent, a fact that leads to the conclusion—and correctly—that the inductions were done for the benefit of the mother.

*Episiotomy.*—There were 68 lateral episiotomies. The majority were done before breech extraction or with forceps operations.

*Third Degree Lacerations.*—Third degree lacerations occurred in 8 cases. Three other patients who had been delivered at home by private physicians were admitted with this injury. Primary repairs were made in all cases.

*Craniotomy.*—Craniotomy was performed in 13 cases. Nine of the babies were known to be dead before the operation. The remaining 4 babies had been so traumatized by prolonged labor and operative attempts at delivery that death was imminent, and the birth of a living baby impossible. No mothers died.

*Cardiac Disease.*—Forty-nine patients had cardiac disease with decompensation. There were 4 maternal deaths. One of them, a patient with advanced chronic nephritis, has been recorded as an anesthetic death. One died after a spontaneous abortion at the twenty-eighth week, and two died of pneumonia, one antepartum and one postpartum.

Thirty-six of the patients were delivered spontaneously, 8 by forceps, 3 by induction by bag and 2 by cesarean section. There were 12 stillbirths and neonatal deaths, including 2 macerated fetuses and 2 abortions.

Our method of treatment consisted in restoring the compensation and refraining from induction or operative delivery while decompensation existed. If anesthesia was necessary, we used gas and oxygen, 3 parts to 1.

*Tuberculosis.*—Twenty-two of the women had tuberculosis. Two died—one undelivered—with tuberculous meningitis. There were 4 infant deaths, 2 being abortions and 1 macerated. Seventeen of the deliveries were spontaneous.

*Syphilis.*—There were 139 cases of syphilis, accepting 3- and 4-plus Wassermann reactions as an indication of the disease. Fifty-four of the infants died; 32 were macerated fetuses and 6 were abortions.

*Prolapsed Parts.*—Prolapse of the cord occurred in 39 cases and in 10 of these there was also prolapse of the arm. Twenty babies, including one set of twins, died; 11 were dead before delivery, and 3 were abortions.

There were 14 cases of prolapse of an arm, with 11 infant deaths. Six of the babies were dead before delivery, 3 of them being macerated.

Four of the babies with prolapsed cord were delivered spontaneously. All the other deliveries were operative, the majority being breech extraction or version and breech extraction. In the babies with prolapse of the arm, version was performed very slowly under deep anesthesia after the prolapsed arm had been painted with iodine and reinserted. We have never found it necessary to do a decapitation in cases of transverse presentation. An exceedingly slow version, that is, with the operator's arm moving at the rate of a millimeter a minute or merely holding the baby's leg without traction, draws the infant around in the relaxed uterus.

In the 53 cases of prolapsed parts, 31 babies died. Twenty of them were dead before the admission of the mother.

#### CONCLUSIONS

It may be stated as a fact that, within my experience, an obstetric service can be conducted with far less morbidity in a hospital maintained for the care of maternity patients only than in a general hospital. In order to keep the mortality rate on a general service as low as on a private service, it is necessary to adopt unusual precautions against infections. We feel that our success during the five years here recorded is due chiefly to the limitation of vaginal and rectal examinations and to the conservative use of operative procedures. In order that the service should be closely controlled, the staff had monthly meetings at which routine procedures for the operative work were discussed and adopted, with the understanding that any member of the staff, either resident or visiting, might vary the routine for the needs of any individual case. Any variations, however, had to be reported at the regular meetings. These standard procedures were accepted gratefully by the resident staff and also by the nurses, who were thus enabled to prepare in advance for operations. Adherence to routine procedures has provided us with statistical studies that are valuable for comparison.

I wish to express my thanks and gratitude to the members of the staff, Drs. Williamson, Gravelle, McCandlish, Conkey, and Driscoll for their prompt response to the demands of the service.

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# THE CLINICAL USE OF OVARIAN FOLLICULAR HORMONE WITH SPECIAL REFERENCE TO FUNCTIONAL STERILITY\*

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ANY procedure that can be of value in treating sterility is justified after reading Dickinson's and Cary's<sup>1</sup> analysis of observations on 12,000 sterile unions, which is anything but encouraging. With a normal husband, a woman married for two years without conception, has a maximum general expectation of one chance in three to conceive as a result of expert medical advice. If she has closed tubes, the chance is one to seven by operation; if infantile uterus, one to four. In the review mentioned above, the main causes of sterility are given as obesity; underdevelopment; anteversion and habitual amenorrhea; salpingitis; appendicitis, and closed tubes; and male causes.

In looking for other causes one must not forget the patient's general condition, hyperacidity of the vaginal secretion, and incompatibility. Formerly, much emphasis was placed on insufficient calcium in the mother, but according to a recent report by Macomber,<sup>2</sup> the effect of a diet low in calcium experimentally in rats, is more likely to cause death of the fetus in utero or of the newborn, than to interfere with conception.

The clinical use of the female sex hormone in our patients has ample scientific foundation, which we would like to review. In 1906, B. C. Hirst derived a glycerin extract of fresh human corpora lutea for injection into patients suffering with various menstrual disorders, with some apparent changes. This work was reported by a student, in the *University Medical Magazine*, edited by the late William Pepper, and Charles H. Frazier, and on file in the library of the College of Physicians of Philadelphia. Similar work from Germany and France was published in 1907. In 1912, 1914, and 1915, came animal experimentations, until Frank in 1917 used fresh liquor folliculi to produce uterine growth in rabbits, publishing the results in 1922. Allen and Doisy<sup>3</sup> followed, showing that lipid follicular extracts of the hog when injected into castrated rats and mice cause striking growth in the female genitals. Much interest was attached to these reports, as evidenced by a great deal of work in the last two years. Allen, again, with Pratt and Doisy<sup>4</sup> showed that the female sex hormone is found in the corpus luteum and placenta, as well as in the ovarian follicles. They found also that the ovarian follicular hormone of the pig, sheep, hen, and human being gave positive tests, according to the smear test of Stockard and Papanicolaou.<sup>5</sup> This same group originated the rat unit as a means of measuring the female sex hormone, as the highest dilution of an extract which when injected into a spayed mature rat three times, four hours apart in one day, will show a positive vaginal smear on the third day. According to this method human females have seven rat units per c.c. of liquor folliculi.

In order to know more of the properties of the female sex hormone, Allen with M. M. Ellis<sup>6</sup> showed that exposure to intense violet rays will destroy its activity.

\*Presented at a meeting of the Obstetrical Society of Philadelphia, March 3, 1927



One of the valuable additions to the subject appears in further work of Frank, published in a series of papers in the *Journal of the American Medical Association*. Under the title of "An Analysis of Factors Producing Puberty," Frank, Kingery and Gustavson<sup>7</sup> demonstrated that by means of injections of the placental hormone of the human being, sexual maturity, follicle ripening, and ovulation may be maintained spontaneously in immature rats. Therefore, puberty is not due to removal of inhibitory glands, such as thymus and pineal, but to elaboration of a female sex hormone. With Goldberger, Frank<sup>8</sup> reports a new method of determining sex in the presence of malformation of the genital organs, i.e., in two cases, by injecting lipid extracts of the blood into castrated mice, producing a positive estral vaginal smear.

The same men<sup>9, 10</sup> were able to report the technic and clinical applicability of the demonstration of female sex hormone in human blood, which begins to appear from ten to fifteen days before the onset of menstruation, increasing to considerable amount at menstruation, when it appears in the flow and disappears from the circulation. In this study, two results appear: (1) Ovulation time should be at the first appearance of female sex hormone in the blood, i.e., from ten to fifteen days before the onset of menstruation. (2) The female sex hormone appears in the blood of pregnant women as early as six and eight weeks, thereby giving probably the most accurate means of determining early pregnancy.

Papanicolau,<sup>11</sup> working with Stockard, contrasts a specific inhibitory hormone of the corpus luteum with the female sex hormone, stating positively that the former is entirely separate and separable from the latter, although each may be present in the corpus luteum. This fact is supported by the work of Zondek and Ascheim<sup>12</sup> also on guinea pigs, as follows:

1. After complete removal of the corpus luteum, estrus is hastened.
2. Although the female sex hormone is found in the young corpus luteum, none is present in the late forms.
3. Lipoid luteal injections delayed estrus indefinitely.
4. There was no effect by oral feedings of luteal preparations.

Finally, clinical tests of the ovarian follicular hormone appear from Pratt and Allen<sup>13</sup> in two divisions:

1. *Animal*.—Experimental work on five spayed monkeys resulted in typical reddening and swelling of the vulva, with reddening of nipples, growth of uterus, and growth of vaginal epithelium with disappearance of white blood cells. Bleeding occurred in seven series when injections were stopped. The author gave thirteen series of injections of female sex hormone, varying from 6 to 190 units per series, covering from nine to twenty days each, giving two or three injections daily.

2. *Human*.—Four groups of women.

- a. *Artificial Menopause* (operative).—Two injections daily for twenty-three days increased the size of the uterus, and produced a heavy sensation in the pelvis.

- b. *Natural Menopause*.—Five daily injections of ovarian and placental extracts of five rat units decreased the number of flashes.

- c. *Primary Amenorrhea*. (No menses after age of twenty).—Five series of injections, ovarian and placental extracts, one to three injections a day, from two weeks to two months. The total number of rat units injected, 15 to 99, failed to produce results.

- d. *Scanty Menstruation*.—Six series of injections yielded some change in all cases.

After this introduction, we present results of the clinical use of the female sex hormone in a small group of women, using ovarian follicular fluid prepared by Parke, Davis & Co., as described in the following letter from their experimental medicine department:

"Our first ovarian products contained less than one rat unit per cubic centimeter. We were able steadily to increase the potency of the product until the last extracts of ovarian source were obtained, representing fifteen units per cubic centimeter. Because of the tremendous consumption of glandular material, however, it would not be practical to make a product from the ovarian source of the fifteen unit strengths.

"The placental extract (estrogen), however, can be made of higher potency. The product which we are sending you and the lot previously supplied was labeled '25 units per c.c.,' but actually tested about 35 units. We have in fact been able to make very much more potent extracts, as high as 150 units, per cubic centimeter. Unfortunately, however, such products are not practical, for the reason that the high refinement of the material undermines its stability. We found that the 150 unit extract had dropped to about 35 units in just a couple of weeks. Just how far we can go with the refinement of the product and still have a fairly stable preparation has not been determined. We feel, however, that we shall be able to maintain the 25 potency, and perhaps that we can go as high as 50 units per cubic centimeter; this remains, however, to be determined."

E. P. Bugbee and A. E. Simond,<sup>14</sup> using the Allen and Doisy rat unit for standardization of the Parke, Davis & Co. female sex hormone, showed that the effective dose should vary directly with the rat weight which would indicate the necessity for much greater dosage in human beings than our patients received. The problem of persuading a patient to receive two or three daily injections over a period of time was our greatest difficulty, and many of our patients failed to appear after a few doses. Such women were therefore rejected along with a group of patients treated rather irregularly nearly two years ago, when our follicular extract contained only about one rat unit per c.c. of fluid.

Our series then includes only 17 patients, each of whom received intramuscular injections of fresh lipid extract of liquor folliculi from hogs in the form of an aqueous colloid solution that is readily absorbed, or a similar preparation of placental derivation. The dosage varied from 25 to 250 rat units in ten day series, and from 3 to 10 injections for each ten days.

#### GROUP I: MENSTRUAL DISORDERS

CASE 1.—Miss S. B., aged fourteen, had suffered with "allergic asthma," for five years. Menstruation began at ten, one period only, since when she has had only periodic leucorrhea and tender breasts, associated with increase in the asthma.

Female sex hormone: Seven injections, 175 rat units, in twenty-one days. No change.

CASE 2.—Mrs. M. N., aged twenty-four, married five years, was sterile. She had been previously treated by thyroid-ovary tablets. Menstruation began at fifteen, 30/1 or 2, scant, with pain and "head flushing." After dilatation and curettage the Rubin test showed that the fallopian tubes were closed. Section; adhesions: Estes operation one side, excision of tube. Thyroid-ovary by mouth;

menstruation still painful, very scant, and short, and occurs from one to two weeks late.

Female sex hormone: Twelve injections, 180 rat units, in 2 series (two months) produced two following periods 28/3, which were markedly increased in amount, without pain or headaches. Patient states that she is glad to have the injections if only for improvement in the periods.

CASE 3.—Miss L. L., aged sixteen, menses at thirteen, every eight weeks, lasting about seven days, with sufficient pain to require going to bed. She complains of constant vertex headaches with dizziness (three years) and peculiar laryngeal stridor. X-ray of pituitary and thymus negative. Wassermann, negative.

Female sex hormone: One series (seven injections), about 100 rat units, resulted in two periods thirty-two days apart, lasting seven days without pain. Headache continued, due to intracranial lesion.

CASE 4.—Mrs. E. S., aged twenty-nine, married five years. Menses began at thirteen, 28/3, and continued up to the age of twenty, when (1918), with nervous breakdown, the periods stopped completely and suddenly, followed by increase of weight from normal of 106 to 149 pounds. Examination shows "infantile uterus."

Female sex hormone: Thirty-four injections, a total of 520 rat units, plus electrical stimulation of uterus, resulted in no subjective change whatever; depth of uterus, two and a half inches (sound). Rubin test was not made; husband not examined.

CASE 5.—Mrs. E. J. S., aged thirty-four, married nine months, no conception. Menses: "showing" only four times in last sixteen months, since a twelve-hour intrauterine application of radium (unknown dosage) for metrorrhagia. Examination showed extreme hyperinvolution, uterus measuring only 3.5 cm. in depth.

Female sex hormone: Eighteen injections, a total of 450 rat units, in conjunction with uterine electrical stimulation, resulted in regular three-day periods. No conception yet.

#### GROUP II: STERILITY

CASE 6.—Mrs. J. M., aged thirty-eight, one child, aged fourteen, by first husband. Menses at fourteen and a half years, 26 to 32/5. Miscarried at two months, four years ago, plus curettage; no conception since. (Second husband.)

Female sex hormone: Two consecutive series, 200 and 300 rat units each, with no apparent change in menstruation. No conception. Husband not examined (refused).

CASE 7.—Mrs. B. T. B., aged thirty-one, married seven years, no conception. Menses began at thirteen, 28/5, no pain. "Flushing" of chest and face (endocrine). Examination showed a normal individual with exception of a small uterus. Dilatation and curettage, Rubin test negative. Thyroid-ovary pituitary tablets given. Husband competent.

Female sex hormone: Two series of injections, 90 and 120 rat units each, produced no apparent results, except a definite increase in sexual response.

CASE 8.—Mrs. M. N., aged twenty-six, married seven years. Menses at fifteen, 30/2; she complained of headaches and pain. No conception; gained 35 pounds. Dilatation and curettage plus Estes operation for closed tubes. Thyroid-ovary tablets without change in periods.

Female sex hormone: One series, 10 injections of follicular extract, a total of 150 rat units, produced an absolute disappearance of pain and headaches, and an increase of amount and duration of menstruation. Husband competent. No conception.

CASE 9.—Mrs. DeF. W. E., aged twenty-six, married four and a half years. Menses at fifteen, 31-32-day type, lasting four days, occasional pain. No conception. Uterus anteфлекed plus stenosis. Husband competent. Rubin test satisfactory. Menstruation distinctly less since curettage and uterus smaller.

Female sex hormone: Follicular injections; one series only of 175 rat units. Result: First following period lasted eight days and free; next period was normal. No conception.

CASE 10.—Mrs. A. I., aged twenty-nine, married three and a half years. Menses at twelve, 28/2, only a trace (one pad). Only conception was in 1924, miscarried at three months; she has gained 24 pounds since marriage. Infantile uterus, anteфлекed. Thyroid-pituitary-ovary tablets. Follicular injection, two series, a total of 200 rat units, resulted in last menstrual period of three days, with flow (3 pads). Weight down to 128 pounds. No conception.

CASE 11.—Mrs. J. H., aged twenty-six, married seven and a half years. Only conception occurred seven years ago, miscarried at three and a half months. Menses began at sixteen, occurring at intervals of from six to fourteen months, with pain; the last period was thirteen months ago. Uterus infantile. This patient has extreme hypertrichosis with beard and mustache; painful coitus, no sexual reaction whatever. Weight 138.5 pounds.

Female sex hormone: After 4 injections (60 rat units), the patient menstruated for three days. Followed by injections twice a week (23—total 345 rat units) this has resulted in no period yet, but has yielded normal sexual appetite and orgasm for the first time. Examination shows a very soft cervix and corpus uteri.

CASE 12.—Mrs. A. W., aged twenty-six, married four years, no conception. Menses began at thirteen, at intervals of from 3 to 8 months, scant. Examination; obese, hypertrichosis, infantilism. No sexual response. Reducing diet.

Female sex hormone: Injections, twice a week for five months, a total of 615 rat units, beginning 4/19/26. Menstruated as follows: June 4, July 11, August 15, September 14; first time with cramps, but none since. Normal sexual reaction. Reduced from 167 to 142 pounds. Husband competent. On 10/28/26, curettage, Rubin test satisfactory. Last period Nov. 26; patient now shows a normal three months' pregnancy.

CASE 13.—Mrs. R. D., aged twenty-four, married seven years. No conception. Menses every two to seven months, of 5 days' duration. Examination showed anteфлекed, infantile uterus. Obese, hypertrichosis. Curettage, Rubin test satisfactory. Thyroid-pituitary-ovary tablets, 50, followed by three monthly periods.

Female sex hormone: Follicular injections, 2 series (January and February, 1926), total 225 units, without any further treatment. Menses remained normal (28/3). 9/2/26 miscarried, University Hospital, ten weeks' pregnancy. Second conception occurred without further treatment, showing normal progress.

CASE 14.—Mrs. M. L., aged thirty-one, married four years. No conception. Menses 24/4, no pain. A woman lawyer, with entire absence of feminine traits, no sexual response, hypertrichosis, infantile uterus plus anteфлекion. Rubin test satisfactory. Rest, iron, and one series of follicular injections (135 rat units) followed by no period, pregnancy; delivered at eight months.

CASE 15.—Mrs. L. B. H., aged thirty, married four years, menses at fourteen, 28/2-5, no pain. No conception. Examination: normal; April, 1926, curettage, showing hyperplasia of endometrium. Rubin test satisfactory. Husband competent.

Female sex hormone: January one series, 250 units, follicular hormone, followed by sense of stimulation; missed February period and is now definitely pregnant.

CASE 16.—Mrs. H. N., aged twenty-two, married one year. Menses began at fourteen, occurred every two to three months before marriage; more regular after. Thin, "masculine type" marked general hypertrichosis, with very infantile uterus, and sexual frigidity. Husband apparently incompetent.

Female sex hormone: Thirty-five injections, totaling 350 units in six months; also slow faradic electrical cervical stimulation. Result: periods less infrequent, i.e., the uterus still very small; menses every six weeks, lasting four days, scant; low sexual response; conception; pregnancy now in sixth month.

CASE 17.—Mrs. S. S., aged twenty-nine, married six and a half years, no conception. Husband competent. Has been treated recently by "stimulating" x-ray exposures. Sexual frigidity. Examination shows normal pelvic organs. Rubin test shows each tube patent at 80 mm. Hg.

Female sex hormone: Three premenstrual series of injections, totaling 750 rat units, produced *marked* increase in sexual inclination and response, but no pregnancy yet.

#### SUMMARY

Of a total number of 17 cases, five were treated for menstrual disorder primarily, with no result in two of the five. Of the twelve potential mothers, six complained of marked reduction in menstruation, yet all were improved, and three of this six conceived, following the female sex hormone injections. Of the six remaining potential mothers, showing no menstrual reduction, two conceived, giving five pregnancies out of twelve possibles, one woman conceiving twice.

#### CONCLUSIONS

1. No ill effects, either local or general, were experienced.
2. Large doses, such as 25 to 50 rat units daily in ten- to fifteen-day series monthly, should help to regulate infrequent menstruation.
3. After excluding *all* other possible causes of sterility, the female sex hormone was used with apparent success, in patients with normal menstruation.
4. The female sex hormone altered the menstrual phenomena after thyroid administration had failed.
5. Normal menstruation is not much affected by injection of follicular hormone. All patients with "sexual frigidity" were relieved.
6. The placental source of the female sex hormone is the logical derivation for practical purposes.
7. At this writing, preparations are under way for testing, by rat experimentation, the amount of hormone in the patient's blood before and after injection. Until this has been done, we shall not recommend general use of the female sex hormone, especially since commercial preparations of the hormone have been found to contain not even one mouse unit.

A careful assay of recent samples of "Estrogen" by Dr. Joseph Hayman, has demonstrated a potency of more than 25 rat units per mil, according to the standardized vaginal smear test after injection of spayed rats.

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1918 PINE STREET.

## OBSERVATIONS ON CERTAIN FEATURES OF THE PATHOLOGY, SYMPTOMATOLOGY, AND TREAT- MENT OF RETROVERSION\*

### A PRELIMINARY REPORT

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THE statistical studies of this paper are based upon the records of 1,153 women with retroversion who were admitted as in-patients to the Gynecologic Service of the John Sealy Hospital, principally as clinic patients of the Department of Gynecology of the University. The clinical observations are based upon these patients (most of whom were directly under my care) and upon 357 patients of my own, observed in office practice, of whom 93 are included in the Sealy Hospital series. Inasmuch as 157 (44 per cent) of these office patients were recent puerperal cases which were relieved by nonoperative measures, and 64 (18 per cent) did not present valid indications for operation, it was hoped that weight might be given to these (and other) percentages by a statistical study based upon the large number of patients attending the Out-Patient Department of the Hospital; this, however, did not prove feasible on account of a faulty system of indexing, which existed until recently. The statistics quoted, therefore, are based upon a selected group of patients in whom certain symptoms existed which, in the opinion of the out-clinic staff, required either closer study or operative treatment, and hence would suggest a higher percentage of cases requiring operative treatment than is true for the unselected mass of patients in whom retroversion is found in the course of routine examination. The ideal statistical study would be based upon the symptomatic and physical findings in an

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adequate number of unselected women, both sick and well. The possibility of such a survey is obviously remote; hence, it will probably never be possible to say just how many, of all women, will fall into the various groups as regards symptomatology, pathology, and the choice of treatment. It is obvious that the conscientious obstetrician will find a higher percentage of cases which do not require operative treatment than will the gynecologist to whom patients with puerperal retroversion do not present themselves until after the possibility of cure by nonoperative measures has been reduced to a minimum.

A consideration of the whole subject of retroversion would require the writing of a small monograph; on this account the commonly accepted features of the subject have been eliminated from this paper, and only those points included which have been of special interest to me. I have adopted these points as reasonably tenable working hypotheses, and as such, they may be stated as follows:

1. Retroversion, uncomplicated by any demonstrable inflammatory or neoplastic condition, may produce severe symptoms. (The impossibility of recognizing, in some cases, the change produced by old inflammatory lesions deep within the tissues, is admitted.) This is demonstrated by three observations:

- a. That 806 patients, of whom the majority were clinic patients in the lower walks of life, presented no other demonstrable cause for symptoms sufficiently severe to make them consent to operation for their relief. (A certain number of these patients had chronic endocervicitis or cervicitis, but the symptoms complained of were not wholly accounted for by this condition.)

- b. That 82.7 per cent of the patients adequately followed up admitted virtually complete relief of symptoms, and 11.9 per cent sufficient relief to make them consider the operation well worth while.

- c. That patients with definite symptoms often have these symptoms, promptly relieved by reposition and pessary support, to recur with the recurrence of retroversion.

2. The majority of cases of retroversion, otherwise uncomplicated, present definite evidence of more or less constant venous congestion of the internal genitals.

3. Following, and very possibly resulting from, this congestion, a progressive replacement fibrosis frequently occurs, involving most markedly the myometrium and the ovaries.

4. Certain fairly definite symptom-complexes occur in otherwise uncomplicated cases of retroversion, and these symptom-complexes have, in this series of cases, been quite constantly associated with the pathologic changes mentioned above (although the degree of congestion and fibrosis cannot be always predicated from the severity of the symptoms).

5. Uncomplicated retroversion is frequently associated with a status of general ill-health with anemia, and this frequently cannot be relieved until after the correction of the retroversion. No explanation is advanced for this phenomenon.

6. The nonoperative treatment of retroversion is eminently successful in appropriate cases, and should be much more extensively taught and practiced.

7. Certain cases of retroversion are amenable only to operative treatment, and the indications for operation (including in doubtful cases the wearing of a pessary as a therapeutic test) are, to me, definite enough to form a satisfactory basis for the selection of cases for operation in practice.

#### PATHOLOGY AND SYMPTOMATOLOGY

*Dysmenorrhea.*—It was interesting to note that, contrary to tradition, very nearly as many patients complained of obstructive (cramping) dysmenorrhea as of congestive dysmenorrhea. In a very large number of those complaining of menstrual cramps, the traditional causes of this symptom were absent; i.e., flexion or stenosis of any type (congenital, inflammatory, cicatricial, neoplastic, etc.).

Pain of ovarian type during the premenstrual and menstrual periods was found to be almost always present in cases of advanced ovarian fibrosis; yet it was sometimes present when little or no gross pathology of the ovaries could be demonstrated. I have come to regard this symptom, therefore, not as diagnostic, but as highly suggestive of some ovarian pathology, usually of a fibrotic nature. I do not believe that a positive differentiation from the somewhat similar pain due to varicocele can be made; yet this differentiation was correct in a surprisingly large number of cases.

*Congestion.*—Very careful study of the ovarian and uterine veins in living patients has failed to show either any constant localization of the dilatation of major veins or any definite mechanical obstruction to the venous flow. The veins are apparently simply engorged (although varicosity may be present), and this condition may involve the uterine or ovarian veins or both, and in the latter may extend above the pelvic brim. On reposition the engorgement may or may not disappear promptly; it usually does disappear in the veins of the broad ligament, to reappear on turning the uterus backward again. No mechanical obstruction, such as torsion, could be observed, even when the veins were exposed by reflection of the overlying peritoneum.

Whether or not the major veins are engorged, the congested uterus is distinctly dusky-red or even bluish, and mottled; its consistency is irregularly softer than normal, and its contour is superficially uneven. Reposition is followed by the appearance of a more normal and even light red color and (usually) by contraction of the myo-



metrium, which makes the organ firmer and paler; when the uterus is very boggy, definite reduction in size may be noted as a result of this contraction.

The microscopic picture of the myometrium at this stage is simply one showing dilated veins with some perivascular fibrosis in otherwise normal tissues. The endometrium in such a uterus usually presents the picture of some stage of hyperplasia.

Menorrhagia is the most frequently observed menstrual symptom of this stage—increase in the amount or in the duration of the flow, or both.

Less definitely, and very much less frequently, there is evidence suggestive of ovarian hyperfunction, with a tendency to decrease of the menstrual interval. There is no definite proof that there is a quantitative relation as regards the amount of flow in cases of ovarian hyperfunction, although menorrhagia is generally included in descriptions of this condition. Inasmuch as in the private office series many of these cases of menorrhagia associated with decreased interval occurred in girls from fourteen to twenty years old, in whom such a phenomenon is frequently seen in the absence of retroversion, the assumption that ovarian hyperfunction occurs as a result of an excess of venous blood due to retroversion cannot be made. Parenthetically, the late development of a decreased interval was found in this and in another study to be the menstrual symptom most constantly associated with acute pelvic inflammation, and is interpreted as being very probably due to hyperemia involving the ovaries before the actual inflammation has reached them.

*Fibrosis.*—Some two or three years after beginning work in the Department of Gynecology of the University of Texas, I noticed that a considerable number of the patients with retroversion of long standing presented a rather definite series of changes in the character of the menstrual phenomenon. At first, there was a progressively increasing menorrhagia, the amount rather than the duration of the flow being increased. Later, the duration of flow was increased, the amount of flow remaining profuse, occasionally increasing, or, frequently, decreasing, especially during the latter days of the menstrual period. Finally, or in some cases coincidentally with any of the irregularities just mentioned, the menstrual interval became irregular and lengthened, the patient menstruating at intervals of from five or six weeks to three months. In most of these cases a preexistent menorrhagia continued, with great variations in the daily amount.

Some of the textbooks of that period made mention of the menorrhagia, attributing it to endometrial hyperplasia, but the other phenomena were not mentioned in any of the literature available.

On searching for an explanation of these so-frequently-seen phenomena, it became apparent that there was, in the cases of fairly recent

origin, a definite endometrial hyperplasia, which would account for the excessive amount of menstrual hemorrhage. In many cases of longer standing, this hyperplasia was absent, and the endometrium was thin, with an excess of fibrous tissue of an immature type in the stroma. The most constant finding, one in fact virtually universal in cases of long standing retroversion, was a replacement fibrosis of the myometrium, with which was associated a marked vascular and perivascular sclerosis. These conditions would easily account for the prolonged bleeding on the theory that the contractility of the vessel walls and the compression effect exerted on the vessels by the network of muscular fibers in the uterine wall was progressively impaired as these muscle cells were hampered and actually replaced by a progressively maturing type of fibrous connective tissue.

The gross appearance of these uteri varies with the degree of fibrosis. The earliest change noted is the appearance of irregular patches of abnormally light color, especially visible when the uterus is in retroversion and is dusky from engorgement with venous blood. On looking at the surface obliquely, the patches are seen to be slightly depressed. In later stages the patches spread, whiten, and become still more depressed. Ultimately the irregularity of surface may become so marked as to be palpable on vaginal examination. In such very advanced cases the bleeding may be continuous, and for obvious reasons not well or at all controlled by oxytocics. Radium, by eliminating the cyclic hyperemia due to ovarian activity, is usually the best treatment for these very advanced cases, but hysterectomy may be preferable or necessary.

The hypothesis that the menorrhagia could be accounted for in early cases by endometrial hyperplasia and in the later cases by replacement fibrosis of the myometrium seemed plausible, but this did not explain the increasing irregularity of the menstrual interval. On further examination, it became apparent that the ovaries in these later cases shared in the replacement fibrosis. A hypothesis was accordingly developed that this fibrosis in some way interfered with the ovaries' share in the menstrual phenomenon and that this interference probably consisted of an impairment of the vascular supply of the maturing follicles, and, in the advanced cases, of a mechanical resistance to the growth of the follicles to an extent which produced a harmful internal pressure, resulting in damage to the essential cells of the follicle. This supposition has not yet been corroborated by the finding of any material diminution of the blood supply to the maturing follicles and the corpora lutea, except as far as may be inferred from the fact that in these cases there is a very marked perivascular sclerosis and often an obliteration of the vessels themselves.

It can, however, be shown that in some of these cases the granulosa layer is thin; its cells are in bad condition, as shown by poor staining qualities, and the retained ovum, when seen, is dead and disintegrat-

ing. In advanced cases, with a great increase in fibrous tissue in the ovarian stroma, very often no maturing follicles or corpora lutea can be found, and these patients are virtually amenorrheic.

With regard to the multicystic conditions which are frequently described, I am inclined to think that there are two distinct types: the first, which may be called the polycystic ovary, seems to be due to a preponderance of cystic atresia over the more usual obliterative atresia, shows little or no excess of fibrous tissue, and is a fertile type of ovary; and the second, which may be called the fibrocystic ovary, in which the major cysts are retention cysts due to the inability of the matured follicle to rupture through the densely fibrous tunica albuginea and stroma, and is a relatively infertile type of ovary.

It must be admitted at this point that the number of histologic specimens so far examined is not sufficient to be considered as making these assumptions conclusive; yet in all cases examined the degree of microscopic fibrosis was found to correspond accurately with what was expected from the gross appearance. The fibrotic areas in these ovaries are whiter than the normal; the ovaries may be diffusely or irregularly enlarged, or, in the late stages, quite shrunk. The surface is usually not fissured (in contrast to the appearance of the normal ovary in the period of premenopausal atrophy and sclerosis). On section, the slightly translucent appearance of the normal stroma is replaced by a white scar tissue, which on close examination may be seen to be most dense under the surface and along the trabeculae. Imbedded in this fibrous tissue are cysts of varying size whose contents are often under markedly excessive tension, and may be bloody. The corpora lutea are very frequently abnormal in appearance, and their walls may be stained a chocolate brown with altered blood. (These must not be confused with endometrial implantation cysts.)

The individual symptomatology of this stage seems to depend upon the balance between the uterine and ovarian dysfunctions. In considering a combination of these two conflicting clinical states, it is theoretically possible that either one may dominate the picture, or that in a given case the major features of each may be associated. Thus, assuming the hypotheses of this paper to be true, a given patient may present an increased and possibly irregular interval (due to ovarian fibrosis) and a menorrhagia (due to uterine fibrosis). As a matter of fact, such cases are common, but the explanation given can as yet be accepted as only a tenable hypothesis.

Table I shows the percentages of cases presenting (at the time of admission) the various menstrual abnormalities mentioned. A considerable number of these patients gave histories of earlier menstrual abnormalities of a different type, and it was in this group, especially as supported by the histories of the more intelligent patients seen in private practice, that the incentive for the present study was found.

In the tables the term *primary* indicates a condition existing from the beginning of established menstrual life; the term *secondary* indicates that the condition developed after a variable number of years of a normal menstrual status or of some other type of menstrual abnormality. It was found impossible to determine in all cases whether the *secondary* symptoms dated to the occurrence of an acquired retroversion; conversely, in many cases *secondary* symptoms made their appearance after a variable period of normal menstrual status in patients whose uteri were known to be retroverted. This last class of patients constitutes the most interesting group, occurs most frequently in private practice, and is most likely to be benefited by the application of the principles of treatment outlined later in this paper. The term *uncomplicated* means that no gross evidence of neoplastic or inflammatory disease was found, except for a certain number of cases of chronic cervical inflammation.

TABLE I. BASED ON THE MENSTRUAL HISTORIES OF 806 CASES OF UNCOMPLICATED RETROVERSION SELECTED FOR ADMISSION TO HOSPITAL (APPROXIMATELY 70 PER CENT OF THE TOTAL NUMBER OF CASES OF RETROVERSION ADMITTED)

Primary Menorrhagia	10.6%
Secondary Menorrhagia	11.1%
Primary Decreased Interval	6.9%
Secondary Decreased Interval	7.4%
Primary Increased Interval	7.8%
Secondary Increased Interval	5.5%
Primary Oligomenorrhea	8.3%
Secondary Oligomenorrhea	2.7%
No Menstrual Abnormalities	40.0%

*Sterility and Abortion.*—Owing to the fact that routine microscopic examination has not been done, and, in the earlier cases, adequate descriptions of the gross pathology were lacking, sterility and abortion can be statistically correlated with the basic pathology only indirectly through the symptomatology; yet these statistics, indirectly obtained, conformed very closely with the statistics based upon the smaller group in which adequate record of the pathology had been made, and were further confirmed by personal observation. For these reasons the present paper can be considered as only a preliminary report. The recent establishment of a special Laboratory of Gynecologic Pathology which will permit the routine detailed study of the pathology of these cases will make it possible to formulate a final report when a sufficient number of cases has accumulated. With the above limitations, the following observations were made.

In the group of cases of *primary* menorrhagia, practically all showed definite evidence of marked congestion, with hyperplasia of the endometrium in the earlier cases and with varying degrees of fibrosis of the uterus in the older cases. Quite a number of these patients presented a hypoplastic or infantile uterus with ovaries of more or less

normal appearance, and may represent the condition known as uterine insufficiency. In the patients with *primary* decreased interval, no constant gross pathology was noted. In the patients with increased interval or with oligomenorrhea, the most usual finding was of some type of hypoplasia, either of uterus or of ovaries or of both.

It must be admitted at the outset that the figures are vitiated by the inability to allow for sterility, due to the employment of contraceptive methods; yet among the clinic patients it was found that contraception was almost unknown and still more rarely practiced.

In considering sterility two definitions were formulated:

*Sterility*: failure to conceive during a period of at least three years of *married* life.

*Married*: subjected to the opportunity for conception which occurs in normal married life. This definition was adopted in order to include the large number of legally unmarried negroes and to exclude the wives of seamen, etc., and the legally married women not living with their husbands.

Approximately 91 per cent of the uncomplicated cases admitted to the hospital occurred in *married* women. A larger percentage of *unmarried* patients occurred in the private office series, after excluding the recent puerperal cases. A curious fact was noted, which may be significant, that the percentage of *unmarried* women was higher among women with *primary* increased interval and with oligomenorrhea than in any other group: 17.6 per cent and 22.2 per cent, respectively, as against an average of 8.8 per cent for all other groups, 4.4 per cent in the menorrhagic group, and 5.8 per cent in the group without menstrual abnormalities.

If the various menstrual abnormalities quoted in Table II could be shown to correspond accurately with the pathologic findings, the table would be of much more definite interest than it is as a mere correla-

TABLE II. STERILITY AND ABORTION ASSOCIATED WITH "PRIMARY" MENSTRUAL ABNORMALITIES

	COMPLETELY STERILE	STERILE AFTER ABORTION	STERILE AFTER ABORTION AND FULL-TERM CHILDREN	STERILE AFTER FULL- TERM CHILDREN	NOT STERILE— ABORTIONS ONLY	NOT STERILE—ABORTIONS AND FULL-TERM CHILDREN	NOT STERILE—FULL- TERM CHILDREN ONLY	TOTALS HAVING ABORTIONS	TOTALS HAVING FULL- TERM CHILDREN	STERILE AFTER ONE OR MORE PREGNANCIES	TOTAL STERILE
Menorrhagia	31.8		9.1	4.5		9.1	45.4	18.2	68.1	13.6	45.1
Decreased Interval	15.4		7.7	23.1		30.8	23.1	38.5	84.7	30.8	46.2
Increased Interval	35.7	14.3				28.6	21.4	42.9	50.0	14.3	50.0
Oligomenorrhea	25.7	7.1		21.4	7.1	14.3	14.3	28.5	50.0	28.5	61.2
No Abnormalities	19.7	3.7	8.7	16.0	3.7	12.6	34.6	29.7	72.9	26.4	46.1

tion of sterility and abortion with these special points in the symptomatology. Taking the figures as they stand, and assuming that the figures given in the last line represent what may be called the norm for patients of the type included, several suggestions become apparent:

1. That patients with primary decreased interval show a primary sterility rate about 75 per cent above the normal and a capacity for producing full-term children about 16 per cent above the normal, while the abortion rate is about 37 per cent above the normal. The explanation at once suggests itself (if we accept that menstruation is a signal indicating the maturation of an ovum) that more than the normal number of ova are being produced in these cases (?).

2. That patients with primary menorrhagia show a primary sterility rate about 60 per cent above the normal, but that their capacity for producing full-term children is only about 7 per cent below the normal, while the abortion rate is 37 per cent below the normal. This suggests that ova find difficulty in implanting themselves upon the menorrhagic endometrium, but once established are likely to go on to maturity (?). Where it was possible to obtain a dependable history (as in the case of intelligent private patients), it was noted that in the *primarily* menorrhagic group a considerable number of *married* women had observed that on one or more occasions menstruation had been delayed for a week or more, to come on finally with excessive cramping, menorrhagia, and the passage of clots. This suggests that in some of these cases very early abortion may occur, possibly from an inability of the endometrium to nourish the ovum past a certain stage in its development. Some weight is lent to this supposition by the finding of tissues of apparently fetal origin in the scrapings from two such patients.

3. That the group of patients with increased interval and the group with oligomenorrhea each show a primary sterility rate about 80 per cent above the norm, and a capacity for producing full-term children about 31 per cent below the norm. The group with increased interval has an abortion rate 43 per cent above the norm. This suggests that fewer ova are being produced, and their quality (as judged by their chances for survival) is poor. The low abortion rate can easily be accounted for by the fact that these women very rarely become pregnant at all, as evidenced by a total sterility rate of nearly 40 per cent above the normal. Obvious explanations for this phenomenon suggest themselves, but cannot at this time be considered as susceptible of even tentative proof.

In the group of patients showing *secondary* menstrual abnormalities, it was found that about 70 per cent of the patients with menorrhagia showed congestion only, while the remainder showed evidence of fibrosis of the uterus. No special gross pathology was found to be asso-

TABLE III. STERILITY AND ABORTION ASSOCIATED WITH "SECONDARY" MENSTRUAL ABNORMALITIES

	COMPLETELY STERILE	STERILE AFTER ABORTION	STERILE AFTER ABORTION AND FULL-TERM CHILDREN	STERILE AFTER FULL- TERM CHILDREN	NOT STERILE— ABORTIONS ONLY	NOT STERILE—ABORTIONS AND FULL-TERM CHILDREN	NOT STERILE—FULL- TERM CHILDREN ONLY	TOTALS HAVING ABORTIONS	TOTALS HAVING FULL- TERM CHILDREN	STERILE AFTER ONE OR MORE PREGNANCIES	TOTAL STERILE
Menorrhagia	4.4		4.4	26.1	8.7	26.1	30.4	39.2	87.0	30.5	34.9
Decreased Interval	20.4	6.6	13.3	20.0	6.6	13.3	20.0	39.8	66.6	39.9	59.9
Increased Interval	9.9	9.9		36.4		18.2	27.3	28.1	81.9	46.3	56.2
Oligomenorrhea	60.0	20.0				20.0		40.0	20.0	20.0	80.0
No Abnormalities	19.7	3.7	8.7	16.0	3.7	13.6	34.6	29.7	72.9	26.4	46.1

ciated with a decreased interval. In the groups with increased interval and with oligomenorrhea fibrosis, especially of the ovaries in the former group, was the rule, the exceptions showing a hypoplastic condition of the uterus, of the ovaries, or of both.

In checking up the histories of the cases listed in Table III, it was found that the sterility and abortion rates for the periods before and after the type of menstrual abnormality existing on admission correspond quite accurately with the figures for the coexistent types of menstrual abnormality as shown in Table II. The tables resulting from this checking up are too cumbersome for inclusion in this paper, especially since by subdivision the number of patients in each group became too small to form the basis for statistical study. One very interesting thing was noted, namely, that women who were markedly fertile early in life, with normal or menorrhagic histories, seemed very prone to develop a secondary increased interval with subsequent sterility; this accounted for the apparently paradoxical figure indicating that patients with secondary increased interval stood third in their ability to produce full-term children (81.9 per cent as against a normal rate of 72.9 per cent).

#### TREATMENT

The nonoperative treatment of retroversion, which for a time fell into discredit, has a distinct and very useful place. Such treatment will be found ineffective in most cases of congenital retroversion and in many cases of acquired retroversion of long standing. In its simplest form, nonoperative treatment consists of avoidance of the dorsally prone position and of the employment of exercises designed to encourage the uterus to tilt forward. Most of these exercises have the knee-chest position as a basis. A very effective method is to have the patient, in the knee-chest position, to raise the knees about six inches from the floor and then to drop them again with a jolt. A

similar effect is obtained by the more strenuous "elephant walk" and "mule-kick" exercises.

The employment of these simple measures in recent puerperal cases during the past two years has had the following effect: the percentage of cases requiring reposition and pessary support has been reduced from 40 per cent to 12 per cent (for the last twelve months).

It is only in the recent puerperal cases (and in a few cases of "intermittent" retroversion) that these exercises will suffice, and resort must then be had to reposition and pessary treatment. Generally speaking, I have found the use of the pessary limited to the following four situations:

1. Puerperal retroversion, in which permanent correction can be secured in from 60 to 70 per cent of cases treated within six weeks after parturition, or after the occurrence of retroversion (which may not take place until some months postpartum) especially if the size and weight of the uterus be reduced by oxytocics.

2. To support the retroverted pregnant uterus until its increased size will prevent the recurrence of retroversion.

3. As a test of the relation of retroversion to obscure symptoms or to sterility. If the symptoms disappear while the uterus is held in position and recur with the recurrence of retroversion after removal of the pessary, operation may be undertaken in these cases with greater certainty of relief; and this experiment is less costly in every way than experimental laparotomy.

4. For the relief of symptoms during a period of postponement of operation, as in the case of a school teacher waiting for vacation, or in a patient suffering from some disease which contraindicates for a time anesthesia or operation.

In developmental (nonpuerperal) cases and in puerperal cases where correction is attempted later than six months after the occurrence of the retroversion, pessary treatment will usually prove of no permanent value, and resort must be had to operation.

Patients without symptoms, who are not sterile and do not abort, should not be treated. The development of a secondary irregularity of menstruation with an increased interval, or with a decreased amount of flow, or with both, is an indication for prompt operation if fertility is to be preserved. Otherwise, the decision in favor of operation is based upon the severity of the symptoms, if nonoperative treatment has failed or is not indicated (as in cases of developmental retroversion or of puerperal retroversion more than two years old).

To review the myriad operations devised for the correction of retroversion would be useless: the effectiveness of any such operation must be judged by: (1) the degree of correction of the retroversion; (2) the permanency of this correction under the stress of normal life and childbearing; (3) the absence of undesirable anatomic conditions



produced by the operation; (4) absence of bad effects upon pregnancy and labor, and (5) operative mortality and morbidity.

In the Department of Gynecology of the University of Texas the operation most frequently employed during the past fourteen years has been that of ventrosuspension by the technic of Dr. George H. Lee. This technic consists of the apposition by (usually) three sutures of the *lower anterior* surface of the uterus to the anterior parietal peritoneum, and is accomplished by simply including in the first three stitches of the peritoneal closure of the laparotomy wound a portion of the anterior uterine wall *well below the fundus*. These stitches include about one-half the thickness of the uterine wall, and are, on an average, about one centimeter long and one-half centimeter apart. Some years ago, I suggested that the lowest stitch be placed just above the uterovesical fold, avoiding the active segment of the uterus and reducing or eliminating the opening below the point of suspension through which internal hernia might occur. It is necessary that chromic catgut be used. By this procedure retroversion is fully corrected. The permanency of the correction may be judged best by the fact that of 665 women in whom this operation has been performed at John Sealy Hospital from January, 1912, to December 31, 1926, only 3 returned for the correction of recurrent retroversion, and not over 8 (the exact number not being available) have been seen by members of the staff, with recurrence.

The operation certainly produces at first a most unanatomic state of affairs, the uterus lying wholly above the pelvic brim and apposed to the abdominal wall. Recent studies, by x-ray and as patients were reoperated upon for other conditions, have shown that the parietal peritoneum at the point of attachment slides downward and backward, finally coming to lie behind the pubis, so that the uterus, originally lying too high and too far forward, comes to lie in (as far as we have been able to judge) about the correct anatomic position. The possibility of hernia under the ventrosuspension band exists; but as yet such an accident has not been seen in this clinic, although there have been two cases of hernia through openings made by *round ligament* operations. The production of a long fibrous band by traction of the uterus has been seen in only three cases, the majority of those subsequently operated upon for other pathologic conditions showing a very slight pulling-out of the fibrous union, most of the required elongation having been brought about by the pulling-out of a bundle of tissue from the anterior uterine wall. This tissue presumably hypertrophies and involutes with the rest of the uterus, judging by its appearance in patients operated upon after having borne children subsequent to ventrosuspension. As regards the effect of the operation upon pregnancy and labor, on account of the floating character of the clinic patients, who come from all over Texas and southern Louisiana, and

refuse to answer questionnaires, it has been possible to trace only 204 cases of all classes over a period of as much as three years. Of these 204 patients 20 were completely sterile on account of salpingectomy. Of the remaining 184, 98 have borne from one to five children each (a total of 129) after the ventrosuspension. The exact figures are not available, but the incidence of abortion was much lower and the incidence of dystocia no greater than the average for women not operated upon in the clinic and in private practice. Unfortunately, in a number of the earlier cases no record of the pathology is available; but from a study of the later cases it is obvious that the success of treatment as regards fertility is most marked in the menorrhagic group, and that no relief of sterility occurred in any case presenting a *secondary* oligomenorrhea with irregular and increased interval of more than two years' standing.

The operative mortality in these 665 ventrosuspensions was three, the cause of death in one uncomplicated case being acute yellow atrophy of the liver; in another, gas bacillus infection one month after operation; the other case being one of suppurating tubal pregnancy, the patient dying of peritonitis. Exact figures on postoperative morbidity have not been compiled, but it was the experience of Dr. Lee, shared by me, that there was greater and more prolonged pain after round ligament operations than after ventrosuspensions.

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### IMMEDIATE REPAIR OF THE CERVIX AFTER LABOR\*

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THE safety of labor in a properly managed maternity, with a staff of adequate experience and skill has of late years become so great that the mortality approaches the vanishing point. Proper prenatal care has aided in greatly diminishing the toll taken by toxemia, hospital sepsis has done away with childbed fever and the obstetrician of adequate training either conducts his case so that hemorrhage does not occur, or if he should encounter it, he masters it in all but an occasional exceptional case. In our own hospital for the past six years the maternal mortality has been 0.26 per cent. In 1926 in 847 cases no maternal death occurred. Sixty-seven per cent of the cases in the Maternity during 1926 were managed by the four men who make up its staff and the remainder by a small group of outside men who adhere carefully to the prescribed technic. This is not an exceptional record but is about what may be expected from any similarly managed institution. Results so far as mortality is concerned in trained hands in properly equipped institutions are exceedingly gratifying.

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We are still lacking in the attention given to some of the common lesions which are caused by labor. In a recent paper I presented some figures in regard to retrodisplacement in pregnancy and labor and at this time I wish to discuss another of the very common results of labor trauma. A large part of gynecologic operative work concerns itself with the repair of the damage done by labor. As we have succeeded rather well in preventing the major disasters of obstetrics, at least in good maternities, is it not time to consider some of the minor casualties and to try to decrease their frequency?

Routine inspection of a large number of cervixes a few weeks or months after labor will show a large number of pathologic lesions. Routine postpartum examination is not done by many practitioners as will be indicated by questioning any considerable series of obstetric or gynecologic patients. Pathology varying from a small area of erosion to deep or multiple tears, and extensive ectropion with large red areas which bleed at a touch may be found. These findings should no longer be dismissed as merely incidental and unimportant. A proper regard for the welfare of the women demands first, that such pathology be prevented if possible, and second, that if it occur, it should be treated.

A review of recent gynecologic literature indicates an increased interest in the pathology of the cervix and in the treatment of cervical lesions. The importance of cervical diseases, particularly chronic inflammations with their resulting irritation of the cervical tissue, as a possible factor in the production of cancer, has long been a subject of discussion. The importance of the infected cervix as a focus from which secondary infections of more or less distant structures may originate is discussed from time to time. While I believe that the cervix is rather infrequently the source from which metastatic infections arise, the repeated raising of the question is an indication of the present interest in cervical pathology. The interest in cervical disease and its treatment is entirely proper, for nowhere else in the body is pathology, as extensive as that which is daily seen in the cervix, permitted to remain over long periods of time untreated. It is merely because cervical lesions are ordinarily out of sight, and only visible when exposed by means of a speculum, and because most ordinary cervical lesions produce little or no disability, that patient and physician are so neglectful of them.

New methods of operatively disposing of infected tissue without greatly changing the cervical structure or seriously impairing its ability to permit normal delivery have been perfected and widely discussed. Nonoperative methods of treating leucorrhea, erosion and ectropion, particularly the use of the electric cautery as suggested by

Dickinson, have been extensively used. These have added distinctly to our resources in managing cervical lesions and are deserving of the praise they have received.

Without giving too much importance to the somewhat nebulous subject of precancerous lesions, chronic inflammatory conditions of the cervix probably play some part in the production of cancer. Attempts to do away with these conditions are right and proper and deservedly engage the surgeon's attention. But may we not go a step further? A large part of the cervical lesions upon which the gynecologist operates, or which he treats by other methods, originate at labor. Is it not possible, by closer intranatal and postnatal attention to the cervix, to diminish later cervical pathology? A careful inspection of the cervix after delivery, even in women who have delivered spontaneously, will show a considerable number of cervixes which show visible damage. For example, a few days before this was written, a primipara of twenty-eight, upon whom no vaginal examination had been made, whose membranes ruptured spontaneously, who had a labor of fourteen hours with an opiate in the first stage and who delivered spontaneously with only the slightest perineal damage, was found to have a one-sided cervical tear four centimeters in depth. Routine inspection of a large number of cases will show that this is far from being an isolated instance.

Formerly it was taught that the cervix should not be sutured unless for hemorrhage. This was because of the fear of infection and because it was believed that the soft, puerperal cervix would not heal well. Even today the obstetric teacher may hesitate to commend too strongly to a class of students an operative procedure for fear that some of them, often in unfavorable surroundings and with limited experience, may do harm rather than good with it. But the teacher himself, with ample training, and the complete physical equipment and trained personnel of a good hospital to aid him, may do with safety and often with benefit to his patients, things which he would hesitate to recommend to his classes for use by those who command none of these things. This state of affairs is not peculiar to obstetrics, for surgical specialists in other fields may regard certain procedures in their respective fields in the same way. My argument is addressed to those who by training and physical surroundings, are able to give parturient women the best that obstetrics affords. May we not, under such conditions, lessen the amount of cervical pathology resulting from labor? And if this be possible, is it not better to prevent the occurrence of abnormal conditions if we can, than to depend entirely upon curing them after they appear?

Every writer upon the subject of cervical cancer stresses the fact that women who have borne children are more liable to the disease than nulliparae. In the opinion of Kelly and Cullen even instru-

mental dilatation of the nulliparous cervix may be looked upon as carrying with it a certain although slight predisposition to cancer. Nearly all, if indeed not all, women who bear children suffer some injury to the cervix. Only a minority of women who have had children have cancer, it is true, but many more women who have borne children have cancer than women who have never been pregnant. Farrar found in reviewing 300 cases of cancer of the cervix that 96 per cent occurred in women who had been pregnant. She reminds us that fifty years ago Emmett suggested the operation of trachelorrhaphy, and inquires whether a return to some of the principles of a previous generation might not decrease the incidence of cervical pathology, particularly cancer.

An obstetrician is a surgical specialist. The obstetrician who has an ample experience in gynecologic surgery is in better position to meet all the emergencies of obstetrics than one whose operative experience is limited to the things incident to labor. The obstetric surgeon should consider it his duty to make, after delivery, a routine inspection of the vagina and cervix. For years no one has contended against the repair of the lacerated or incised perineum. The substitution of episiotomy for laceration is but replacing a jagged and irregular wound by a clean regular incision, placed according to the surgeon's judgment and better adapted to thorough surgical repair. Proper perineal repair after labor has greatly lessened the discomfort of women due to relaxation of the pelvic floor. Why is it not equally logical to repair a cervical injury?

To ascertain the frequency of cervical laceration I have gone over the records of 975 private cases delivered during the years 1924, 1925, and 1926 by myself and my associate, Dr. C. E. Galloway. Of these, 427 are primiparae and 548 multiparae. There were 36 cesarean sections. Manual dilatation, always of the effaced and partly dilated cervix, was done 17 times. Bags were used 18 times. Excluding from this number all cases in which manual dilatation, even of the least degree was done, all cases in which a bag was used and all cases of cesarean section, we have 904 cases remaining. There are no cases of high forceps. Version was done 25 times.

For some years we have inspected routinely all cases, except multiparae who deliver spontaneously and easily, to ascertain whether any cervical damage has occurred. The cervix is examined in all primiparae regardless of the character of the delivery. We have found lacerations of the cervix of a degree which would seem to us to warrant attention in 102 cases, of which 69 were primiparae and 33 multiparae. Of these 102 lacerations, 24 were found on the right side of the cervix, 19 on the left side and 26 were bilateral. In 39 cases the record showed that a tear was found but did not indicate upon which side. In three cases there was a tear of the posterior cervical

lip. In 58 cases the tear was less than 2 cm. in extent. Of the 44 which were 2 cm. long or more, 10 were 3 cm., 2 were 4 cm. and 1 was 5 cm. in length.

While we do not attempt to assign an arbitrary dividing line based on length between those which are to be sutured and those which are not, tears of 2 centimeters or more are sutured, and those which are of less extent may or may not be according to the apparent tendency of the tear to fall together or gap.

Injury to the cervix is avoided so far as possible. The bag is used but rarely and manual dilatation is infrequent. When manual dilatation is used it is only when effacement is complete and dilatation of 5 or 6 cm. is already present. It is usually used under these conditions to assist a woman who is fatigued from a long first stage, in order that she may be gotten into the second stage before her strength is spent. It is not a frequent necessity.

Bags are used only when toxemia renders energetic measures for induction of labor necessary, or for placenta previa. Even with this conservative attitude we find that damage to the cervix during labor is a frequent occurrence.

When a tear of the cervix is found which seems extensive enough seriously to alter the shape and appearance of the cervix, it is repaired at once. There seems today no more valid surgical reason to allow a deep cervical tear to remain uncared for than to allow wounds of the face or scalp to heal as best they may without suture.

To obtain satisfactory results we have found that certain rules must be followed. Adequate exposure is, of course, essential. This requires an assistant, an instrument nurse and proper light, operating-room conditions in brief, and these are present in any well-ordered maternity. Under these conditions exposure is almost invariably easy. Traction must be evenly made on both sides of the tear. One side must not be pulled upon more than the other as the repair may be caused to be uneven and the cervical ring ultimately irregular. The best instrument for drawing down the cervix is the light cervical ring forceps of DeLee, of which two are needed.

There is a tendency for the muscle of the cervix to retract so that the mucosa of the inner and outer surfaces of the cervix project beyond it and the cross-section of the tear is "V" shaped. The suture must be passed sufficiently far from the edge that the deepest part of the "V" is included. Should only the edges of the mucosa be included the suture tends to cut through easily and the result is seldom good. One may even grasp the outer mucosa only, leaving most of the muscular layer and the inner mucosa. Interrupted sutures are best, at intervals of about one centimeter, and should be tied only tightly enough to produce apposition.

For years the only cervical tears I sutured were those from which hemorrhage occurred. All others were let alone because of the fear that infection might follow suture. As this did not occur in those in which suture was done for bleeding, it seemed fair to extend the use of sutures to a larger number of injured cervixes. The routine use of sutures in lacerated cervixes has not increased the incidence of puerperal infection. There seems to be no good reason why it should.

That this routine care of the cervix is agreed to by other men of experience is shown by the fact that in Philadelphia, the two men who for years dominated obstetric thought have both repaired the cervix, one at once, the other within a few days. Both agree, however, in not permitting the woman to return to activity without some attempt at preventing later pathology. It appeared, however, in a recent discussion that attention was more actively centered upon the healing of cervical lesions than upon their prevention.

Results have been reasonably satisfactory. It is true that in some cases a small notch will be found at the lower end of the tear a few weeks later which may allow some rolling out. Many cases heal satisfactorily and at follow-up examination show cervixes which are well closed. Because we cannot in every case attain complete perfection does not seem a valid reason for not preventing as much pathology as we can.

It is not intended to discuss the treatment of cervical lesions generally. The obstetrician's period of observation should include at least one examination six to eight weeks after labor. At this time subinvolution and misplacement will be discovered if present, and subinvolution and the condition of the cervix will be noted. Ectropion and erosion found at this time if not too extensive may be greatly improved by the use of the small electric cautery.

It is desired to emphasize the fact that pathology of the cervix may often be prevented. If it cannot be wholly prevented it may at least be lessened. In preventing or at least lessening cervical pathology we are rendering a greater service than in curing lesions of the cervix later.

708 CHURCH STREET.

*(For discussion, see page 563.)*

# THE TOXICITY OF BLOOD SERUM PROTEINS IN ECLAMPSIA

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THE blood serum in eclampsia has been assumed to be more toxic than that in normal pregnancy.

The literature on this subject dates back to the work of Rummo<sup>1</sup> in 1891 who found that the toxicity of the blood serum in eclampsia was increased over that of the normal. Tarnier and Chambrelent<sup>2</sup> the following year reported an increased toxicity in blood in eclampsia of a patient. Mairet and Bosc<sup>3</sup> studied the toxicity of various normal serum and concluded that 15 c.c. of normal human serum per kilo of kilo weight of rabbit was the fatal dose. Bar and Renon<sup>4</sup> also found an increase in the toxicity of blood serum in eclampsia. Ludwig and Savor<sup>5</sup> came to the same conclusions. Volhard<sup>6</sup> in 1897 concluded that there was no difference in the toxicity of the serum in normal and eclamptic individuals. Schumacher<sup>7</sup> supported Volhard's conclusions. Semb<sup>8</sup> in order to get rid of the toxicity of normal serum immunized his animals and found that after immunization the serum in eclampsia usually produced fatal results. The work of Dreyfuss<sup>9</sup> with relation to the toxicity of the serum was too limited to form the basis of any conclusions. Graf and Landsteiner<sup>10</sup> found that 13 out of 19 cases of eclampsia showed increased toxicity of the serum. They believed this to be merely an increase in the amount of the normally present toxic substances. Gessner<sup>11</sup> in 1920 on the basis of the changes that he observed in the kidney claims that they present a picture rather of undernourishment than that of the action of toxin. Bumm<sup>12</sup> by transfusion experiments in which he reached quantities as high as one litre, injecting the blood of an eclamptic patient into a normal patient without producing any effects concludes that there is no toxin in the blood of eclamptics. In a discussion of his work he admits that his results might be explained in a different way. Levy-Solal and Tzanek<sup>13</sup> again find that intracardiac injection of serum from eclamptic patients shows a greater toxicity than that from normal pregnancy.

No effort has been made to separate the fractions of proteins and study the different fractions. It seemed to us that it would be interesting to make an observation of the toxicity of the proteins from normal serum and from the serum of eclamptic patients.

## EXPERIMENTAL

The blood used in this study was obtained from two eclamptic patients (intrapartum and postpartum) whose histories follow:

Patient M. B. was received in the Cook County Hospital on January 28, 1925, in a comatose condition. The history was given by the mother. Pains in the "stomach" had been present for two days. Headache began two weeks previously and had become so severe as to prevent sleep and cause vomiting. The amount of urination had decreased. No edema had been observed. She had three convulsions before entering the hospital. Her past history contained nothing of interest.



Physical examination revealed a well-developed, well-nourished colored girl, fifteen years of age, in coma. The essential findings were, dilated pupils, blood pressure of 202/115, a full term contracting pregnant uterus with a live child and dilated cervix. After the routine eclamptic treatment and the delivery of the child, the patient continued to have convulsions, eight in succession, after which she became quiet and slowly her condition improved. The urinalysis showed four-plus albumin, casts, white and red blood cells. The blood chemistry showed no retention. The Wassermann test was negative. The patient recovered and on February 9, 1925, was discharged having a blood pressure of 124/88 and normal urinary findings.

The second patient, C. H., entered Cook County Hospital on January 27, 1925, in labor and delivered a premature child. She had had two full-term spontaneous deliveries and three spontaneous miscarriages. She had had measles, mumps, chicken-pox, malaria and influenza. Physical examination negative. The following day she complained of headache and vomited. Her blood pressure was 225/135. The following day she had several convulsions and in spite of the usual therapeutic measures, she died. No autopsy was permitted. Urinalysis showed albuminuria four plus and casts. Blood chemistry showed only a uric acid retention of 4.50 mg. per 100 c.c. of blood.

*Technic.*—This fractionation was carried out according to the method outlined by Hektoen and Welker.<sup>14</sup>

The blood serum proteins were dissolved in normal saline solution so that one cubic centimeter of the solution represented 25 mg. of the protein. The solution was injected intraperitoneally into white mice, weighing 18 to 20 gm. The initial dose was small and larger doses were given to separate mice. Three cubic centimeters was usually the maximum amount of fluid tolerated by the mice intraperitoneally. When this limit was reached a solution of 50 and then 75 mg. to the cubic centimeter was used. Euglobulin could not be tested because it was only soluble in 10 per cent saline solution which in itself was toxic because of its hypertonicity.

The results are given in Table I.

TABLE I. TOXICITY OF BLOOD SERUM PROTEINS  
(Injected intraperitoneally in mice)

	ALBUMIN	PSEUDOGLOBULIN	46-64	EUGLOBULIN*
Normal Serum	75.0 mg.	225.0 mg.	225.0 mg.	-
Serum 500†	62.5 mg. 75.0 mg.	300.0 mg.	No specimen	-
Serum 501‡	No specimen	150.0 mg.	225.0 mg.	-

\*Three-tenths cubic centimeters of 10 per cent sodium chloride solution caused death when injected intraperitoneally into a 20 gm. mouse. Since this is the solvent used for euglobulin, no toxicity experiments were made on this protein.

†Serum 500 obtained from patient with intrapartum eclampsia.

‡Serum 501 obtained from patient with postpartum eclampsia.

None of the blood serum proteins proved toxic in the experiments except the albumin of serum 500. In one mouse, 62.5 mg. were lethal while in repeated experiments 75.0 mg. were nontoxic.

The amount of protein injected represents roughly the equivalent of  $1\frac{1}{2}$  to  $1\frac{1}{2}$  c.c. of blood serum in the case of the albumin and 14 to 17 c.c. in the case of the pseudoglobulin.

## CONCLUSIONS

The blood serum proteins of normal and eclamptic women's blood showed no experimental evidence of toxicity in mice although injected in large doses intraperitoneally.

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## CORPUS LUTEUM HEMATOMA

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THE term, "corpus luteum hematoma," designates excessive hemorrhage localized in the central cavity of a lutein body. This pathologic bleeding is an accentuation of hemorrhage occurring normally during the development and involution of the corpus luteum. As first demonstrated by Sobatta and later confirmed by Honore, Frankel, and Schroeder, rupture of the graafian follicle is not associated with bleeding into the central cavity. The developing lutein body is, therefore, free from blood in its early congestion stage. Personal observation in fourteen cases in the human ovary has confirmed this finding. Early in the vascularization stage, blood, however, makes its appearance in the central cavity of the corpus luteum. In a study of fifty ovaries with lutein bodies in this stage, the bleeding can be traced from the congested capillaries in the theca externa through the lutein column which it dissociates into the central lutein cavity. Along these avenues blood vessels and fibrous septa appear somewhat later. Grossly this hemorrhage is prominent. It produces a narrow circumscribed zone of blood, 0.5 to 2 mm. in thickness and in immediate contact with the lutein column. During the stage of efflorescence of the corpus, the hemorrhagic zone is slightly less prominent, due to hemolysis. Fresh bleeding, however, does not occur.

With the death of the ovum liberated during previous follicular rupture, lutein involution begins. In a study of six regressing corpora removed from the fourth to the eighth day in the menstrual

cycle, involution was found associated with additional bleeding into the central cavity. In half the cases the entire central cavity was compactly filled but the latter was irregular and contracted. In the remainder, slight to moderate quantities of fresh blood could be traced into the central cavity. This proceeds from the congested capillaries in the inner fibrous core and in the lutein column. Even in involuting corpora of the fatty and hyaline stages, additional recent hemorrhage can be traced from the persisting capillaries. This is in keeping with the findings of Schroeder, Marcotty and Aschoff, who noted recurrent bleeding in regressing corpora lutea with each subsequent menstruation. This persists until capillaries have been finally obliterated in the corpus albicans stage. It will be seen, therefore, that physiologic bleeding occurs into the central cavity of the corpus during early vascularization and initial regression stages. The lutein hematoma results from accentuation of this bleeding.

In the study of 32 cases here presented, corpora lutea were considered hematomas when half or more of the central cavity was filled with blood, thus allowing amply for variation within the normal. In the involuting group of corpora, the enlarged and dilated and blood-containing cavity formed the chief criterion of excessive central bleeding.

During operation the gross appearance of unsectioned ovaries, the seat of lutein hematomas is frequently obscured by the dense adhesive bands fixing the organs to the uterus or broad ligament. In their removal many are consequently so mutilated that they are unfit for proper detailed study. As a rule the ovaries are moderately enlarged, averaging 5 by 3 by 2.5 cm. When the hematoma is of unusually large size or when multiple ones are closely set, the reflected blue-black color of the organ is suggestive. After section, however, the appearance is typical. Multiple or solitary, sharply defined blood collections lie in the cortex and medulla. The largest hematomas may occupy the entire organ (Fig. 1); the smallest functioning lutein hematomas equal that of a normal "corpus luteum" (1.5 to 2 cm.). The majority, however, are moderately larger and average from 2 to 3 cm. in size (Fig. 2). In the regression stage they average from 10 to 15 mm. and are larger than corpora in the similar regressive phase. The boundary of the central hemorrhagic zone is formed by a lutein layer which varies in thickness with the extent of bleeding. In the largest the epithelial column is barely grossly recognizable, and convolution is reduced if not entirely lacking. In the recent hematoma the grey brown lutein layer contrasts strikingly with the bright red hemorrhagic center; in older regressing forms the lipoid laden cells transmit a canary-yellow color contrasting with the brown central zone and its partially reduced blood. In the oldest the blood is blue black and frequently liquified so that on section tarry or chocolate fluid escapes from the cavity. In these, the limiting membrane is formed by a wall of fibrous tissue. Intrafollicular hemorrhage is frequently associated, and the reflection of blood through the thin cyst wall is grossly striking. Interstitial bleeding is occasionally met and is generally adjacent to the follicular or lutein hematomas. The general engorgement of the organ imparts a pinkish hue to the grey stroma.

The distribution of the hematoma in the cases studied was as follows: In twelve cases the hematomas were bilateral, in four only one side was involved. In the

remaining sixteen cases only one ovary was available for study, thus allowing no interpretation. Multiple hematomas in the same ovary occurred in eight cases and varied from 2 to 3 in number.

Microscopically the features of hematomas vary with the size and age of the corpus luteum. The persistence of their physiologic function is gauged in the more recent hematomas by the cyclic change of the uterine mucosa and further checked by the menstrual date. The presence of recent and old hematomas in the same organ indicates a recurrent process. It must be emphasized, however, that normal corpora in the congestion, vascularization, and regression phases were encountered in ovaries, the seat of older lutein hematomas.

Hematomas in corpora lutea of vascularization were noted in six cases. In all, the lutein layers were reduced in number. The individual lutein cell, however, is only slightly altered. Between the cell column course engorged capillaries. Interstitial bleeding could be traced through the lutein column into the central cavity. As shown in Fig. 3, the hemorrhage is occasionally so intense that lutein cells are

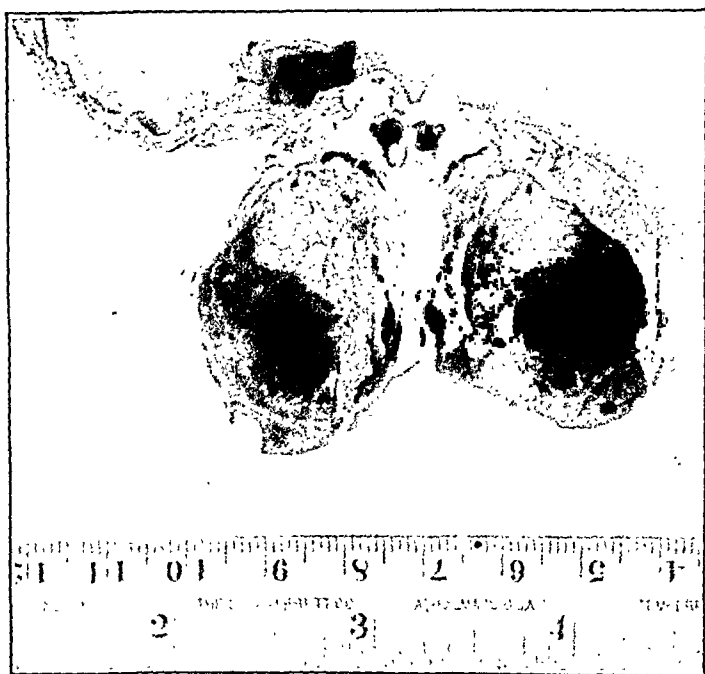


Fig. 1.—External view of ovary, the seat of a large corpus luteum hematoma. The organ is almost completely filled. The lutein layer is flattened, and all convolutions have disappeared.

detached and lie in a necrotic state mingled with the red cells of the central cavity. In four cases the latter was compactly filled with blood. In the two largest the inner zone of the central cavity was filled with fine fibrinous coagulum. The outer half of the cavity, adjacent to the lutein column, was compactly filled with preserved red blood corpuscles. These represent cystic corpora lutea in the vascularization phase with excessive bleeding. Several albicans cysts in the same ovaries indicate repeated formation of these cystic corpora. The theca-interna cells were normal for this developmental stage of the corpus. In three of the cases the endometrium was available and presented typical cyclic changes of the early premenstrual mucosa. Function, therefore, was retained in the corpus; the bleeding was not sufficient to produce complete pressure atrophy of the lutein column.

Hematomas in corpora lutea of efflorescence were present in five cases. In these, a central fibrous band separated the central blood-filled cavity from the lutein layer (Fig. 4). In one of the cases the hematomas occupied the entire ovary and measured

4.5 by 4 by 3 cm. The lutein column was barely recognizable, being flattened and free from convolutions. The regular central cavity was compactly filled with well-defined and normal red blood cells. The adjoining fibrous band was well organized and held capillaries. The lutein column was comprised of only from four to six cell layers, compressed and reduced in size. Between them the contracted capillaries with associated fibroblasts traversed the entire column. No theca-interna cells were present. The remaining cases present hematomas varying from 2 to 2.5 cm. in size. The lutein column was greyish-yellow, thin, and defined. The dilated central cavity was filled with normal red blood cells, and in all was separated from the lutein column by a well-defined fibrous ring as typical of a normal corpus in efflorescence. The lutein layers were moderately reduced and averaged from 12 to

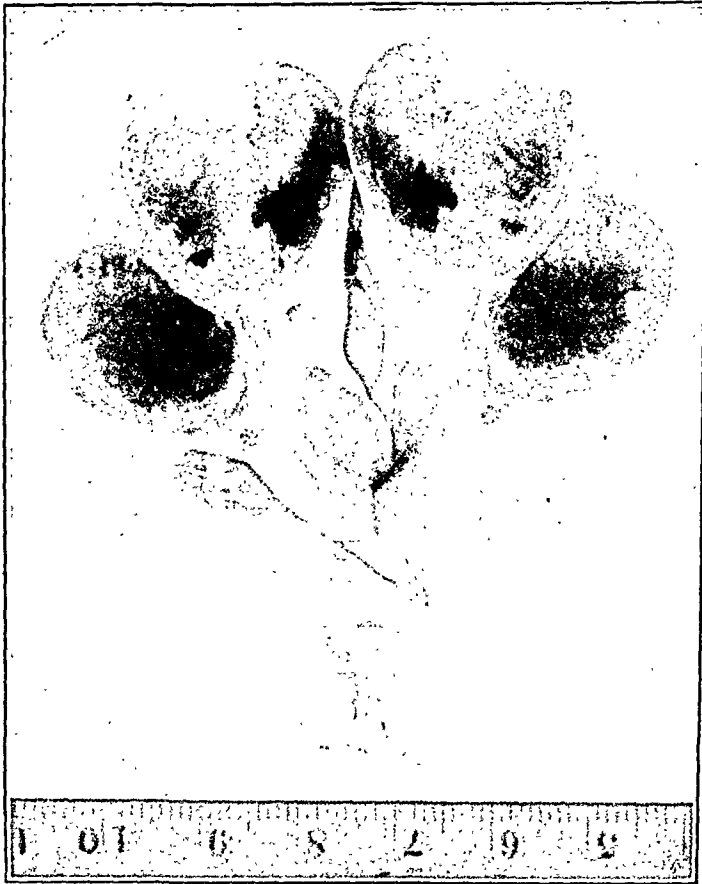


FIG. 2.—Multiple lutein hematomas of the ovary. The lutein layer is barely recognizable; the cavities are dilated and compactly filled with blood.

15 in number. The cells, however, were normal, and the capillaries were free from change. Excessive bleeding had evidently occurred in the preceding vascularization phase, for the capillaries in the lutein column and in the inner fibrous core were contracted. The endometrium available in two cases displayed typical late premenstrual changes.

Hematomas of regressing corpora lutea were found in twenty-one cases. This was to be expected, for the regressing stage of corpus luteum is normally protracted over a period of several months. An important question suggests itself at once. Are these regressing forms the end stages of hematomas arising during vascularization, or do they represent hematomas originating during the early involution of a normal corpus luteum as the result of excessive bleeding at this time? The state of organization of the central cavity in a large measure decides the



Fig. 3.—(x 120) Corpus luteum hematoma in the vascularization stage. Bleeding has detached some of the lutein layers which lie in the central cavity, surrounded by a broad hemorrhagic zone.

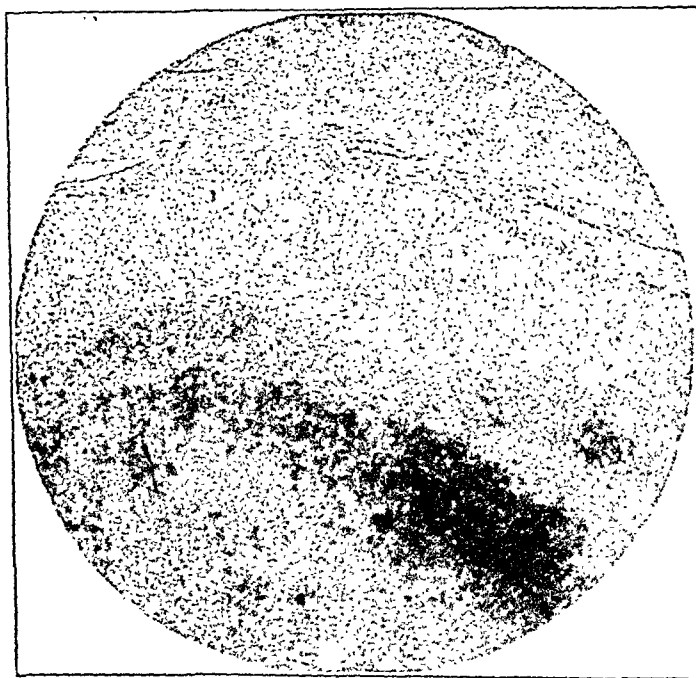


Fig. 4.—(x 120) Corpus luteum hematoma in stage of efflorescence. The lutein layer is preserved, and a wide fibrous band separates the blood-filled cavity from the lutein column.

question. If a central fibrous band or irregular fibrous zone is lacking in the central cavity even at this stage, thus permitting direct contact of blood with the lutein cells, it is reasonable to assume that excessive bleeding interfered with organization, and the hematoma, therefore, developed prior to involution of the corpus.

The larger size of these forms and the wide central cavity lends weight to this view. Crenation, fragmentation, and hemolysis of the red cells are of no aid in differentiating early or late organization, for erythrocytes of the early vascularization would still be preserved during early involution. It aided, however, in the demonstration of recurrent bleeding in lutein hematomas when preserved red cells were found intermingled with older disintegrating erythrocytes.

Unorganized regressing hematomas comprised nine of twenty-one cases. Their size and structure varied with the degree of regression from ten to fourteen millimeters in size. In all the central cavity is wide and dilated. The blood cells were well preserved and in direct contact with the fatty or hyaline lutein column. No intermediary fibrous zone was present. In the two oldest, large clusters of hemosiderin laden phagocytes were encountered. Only on repeated section was a narrow rim of hyalinized lutein found to indicate the origin of the hematomas.

The remaining twelve hematomas show evidence of central organization (Fig. 5). In the largest two, a narrow fibrous core of hyalinized stroma intervened be-

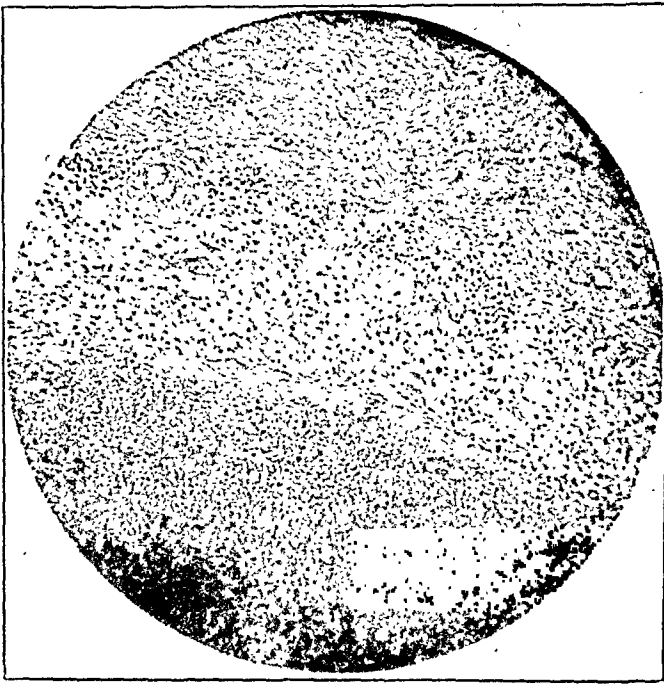


Fig. 5.—(x 120) Hematoma of regressing corpus luteum. The central cavity is compactly filled with blood. A narrow hyaline fibrous layer is in contact with the fatty lutein cells.

tween the central hematoma and the lutein column which presents the picture of incipient regression. Blood could be traced from the capillaries of the central fibrous zone into the cavity. Yet this was hardly sufficient to account for the excessive hemorrhage in these large hematomas. They were accordingly interpreted as hematomas of the vascularization stage with insufficient central pressure to prevent organization of the corpus in its functional state. Additional mild bleeding occurred during involution. The remaining ten hematomas were older. The central cavity contained hemolyzed blood, and a broad zone of concentric fibroblasts immediately encapsulated the hemorrhage. Numerous mononuclear cells gave evidence of continued organization and the large numbers of pigment laden phagocytes between the fibroblasts indicate considerable duration of the hematomas. In only three did repeated section successfully demonstrate narrow segments of fatty or hyalinized lutein cells, indicating the nature of the hematomas. In the remainder, the blood was in direct contact with a wide zone of fatty collapsed lutein cells.

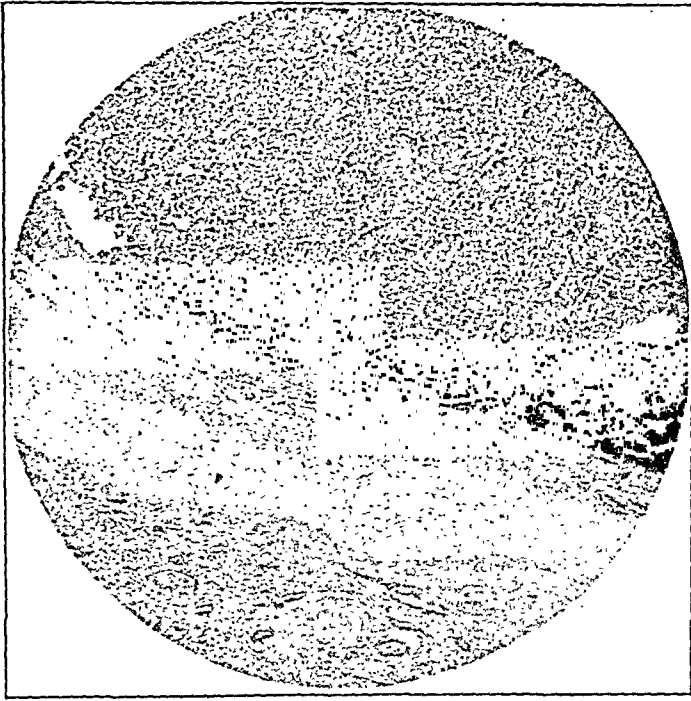


Fig. 6.—(x 120) Hematoma of corpus albicans. The central cavity is unorganized and filled with blood. The lutein column shows typical hyaline change.

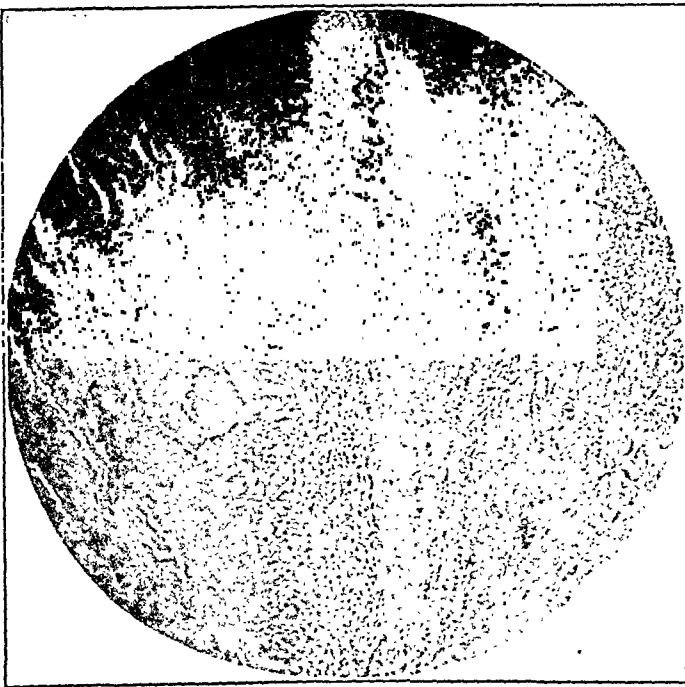


Fig. 7.—(x 120) Hematoma in a corpus luteum of advanced regression. The central cavity holds hemolyzed and preserved red cells. The surrounding fibrous layer is filled with hemosiderin laden phagocytes. The recent recurrent hemorrhage proceeds from the capillaries in the fibrous zone.

The time of occurrence of the extensive bleeding in these hematomas is difficult to interpret. The impression is that of hematomas arising during vascularization with recurrence of additional bleeding in the later phases of regression.

Vascular hyperemia of the ovary was the underlying factor of the excessive



bleeding, as shown by the associated pelvic pathology. In the thirty-two cases of hematomas twenty-seven displayed pelvic peritonitis dependent upon salpingitis; one of these was tuberculous in origin. Three cases were associated with fibroids of the uterus. Static factors are indicated by two instances with retroflexion and prolapse of the ovaries. The pathologic effusion into the corpora lutea during vascularization is the result of extensive congestion of the ovarian capillaries. Rupture of such thecal vessels in early vascularization liberates an excessive quantity of blood. The mechanism of the physiologic and pathologic bleeding is therefore the same. The time of origin is most frequently in the interval of the cycle. The origin of hematomas during regression is difficult to prove from the material studied, but recurrent bleeding undoubtedly occurs in this phase.

The symptoms of corpus luteum hematomas are difficult to interpret as to cause and effect, because of the frequency of salpingitis and peritonitis associated with the ovarian lesions. Fibroids and retroflexion also obscure the clinical interpretation. Of thirty-two cases, twenty-three had menorrhagia and three, metrorrhagia. The remainder showed no menstrual anomaly. Submucous fibroids easily accounted for the symptoms in two of the cases. The second most common symptom was menstrual pain and was noted by twenty-four patients. In two this was acute in its onset and began ten to twelve days before the last period preceding surgical removal of the organ. The ovary showed a huge solitary hematoma of vascularization in each case. The majority, however, had dull pain in both lower quadrants, beginning three to four days prior to menstruation and continuing for from one to two days of the period. In three cases pain persisted throughout the menses and these ovaries presented multiple hematoma.

#### CONCLUSIONS

1. Rupture of the graafian follicle is not associated with bleeding into the follicular cavity.
2. The normal corpus luteum shows moderate central bleeding into its cavity during the vascularization stage. Grossly it appears as a narrow zone in contact with the lutein columns.
3. Secondary bleeding follows with beginning involution and, hence, is associated with menstruation. Recurrent bleeding into regressing corpora follows with every subsequent menstruation until the corpus is transformed into an avascular corpus albicans.
4. The corpus luteum hematoma differs from the normal corpus hemorrhage in the excessive quantity of bleeding into the cavity of the corpus. Half or more of the cavity is compactly filled with blood.
5. Excessive bleeding is the result of pathologic hyperemia of the ovaries, dependent upon salpingitis, fibroids, or displacement.
6. The integrity of the lutein column and the function of the lutein hematoma vary inversely with the quantity of the bleeding. Functioning hematomas with corresponding cyclic change in the endometrium have been noted in the vascularization and efflorescence phases. Regressing corpora lutea, however, comprise the majority of hematomas because of the normal prolongation of this stage.
7. Hematomas in regressing corpora lutea represent in many in-

stances the involution stage of hematoma of vascularization; additional bleeding has occurred during involution.

8. In the most advanced hematomas the lutein phase at the time of origin cannot be fully determined.

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1530 PRESIDENT STREET.

## A CASE OF FIBROADENOMA OF THE BREAST

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REPORT OF PATHOLOGIC SPECIMEN BY PHILIP HILLKOWITZ, M.D.  
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**M**AMMARY hypertrophy as found in adolescence and adult life is described in textbooks as one of the anomalies of the breast. It means a uniform diffuse growth of the organ, both as to the parenchyma and the stroma in the same proportion as in the normal breast. The case here presented, however, is one in which there was true tumor formation, and on account of its rarity is, therefore, deemed worthy of record.

The young girl here pictured (Fig. 1) lacked ten days of being fourteen years of age when the breasts were removed on January 6, 1927. Breast development had been noticed by her mother in April or May and up to the first part of November, "they were but little larger than breasts commonly observed in girls of her age." Rapid growth then began, so that their present large size was attained in approximately three months.

A few days before she was brought in for examination, the skin on the anterior surface of the left breast had broken, keeping up such a continued leakage of serum that the child's clothes were constantly wet. This complication accompanied by the feeling of shame from her deformity had determined the decision for operation. There was discomfort and fatigue from the weight of the breasts but no pain.

The physical examination was normal but for an undernourished condition and the extreme size of both breasts; these were pyriform in shape, the left a little larger than the right, and both reaching down to slightly above the symphysis pubis. They were smooth, tense, and of uniform consistency. There was a slight growth of pubic hair. No pelvic examination was made because of the child's extreme sensitiveness; she had not yet menstruated.

The present case was thought to be one of simple hypertrophy until after removal, when cross-sections of the breasts showed many lobulated tumors; these on microscopic examination proved to be multiple fibroadenomata. The description of the breasts after removal is as follows:

The right breast weighed 15 pounds (7 kilograms); the left, 12 pounds (5.5 kilograms). The overlying skin was smooth and tense, no nodular elevations being seen on the outside. The consistency was somewhat fluctuating. On section the tissues were quite edematous. A considerable number of nodules of various sizes, surrounded by a capsule, was seen in each breast (Fig. 2).

Examination of the sections (Fig. 3) revealed a stroma of fibrous connective tissue in which were acini lined by two layers of cuboidal epithelium, in place of columnar. Some of the acini were dilated and filled with a granular or hyaline material.

As to the relative proportions of the parenchyma and stroma the fibrous elements made up the larger share. On account of the edema the fiber bundles were separated by hollow spaces. There was a fairly abundant network of capillaries. In places the acini showed branchings and shallow indentations.

#### DISCUSSION

The presence of distinct nodules and the gross and microscopic differences from the appearance of normal nonlactating breast tissue classifies this specimen as a fibroadenoma. The absence of areas of adipose tissue would also add strength to this diagnosis. The microscopic appearance, it is true, differs from the usual picture of the intracanalicular and pericanalicular fibroadenomas seen in adult life, where the stroma is relatively more abundant and exerts pressure on the acini. Nevertheless we are dealing here with a true neoplasm, as the nodules are independent structures and have apparently no functional relation to the normal breast, the ducts being shut off from the rest of the organ.

As to the etiology of fibroadenomas, the same unknown cause or causes operate as in the formation of tumors in general. The theory of latent rest in such cases is rather alluring. Some small portion of the original organ in the early state of its evolution is separated from its fellows and later grows independently. Both the epithelium and the stroma with its vessels must be involved in order to make up eventually the neoplasm with its fibrous and epithelial elements.

The patient menstruated for the first time one month after the operation and continued regularly; she picked up rapidly in health and gained sixteen pounds in two months.

Considering different types of enlargement of the breasts, one commonly sees in the newborn infant, either male or female, a temporary hypertrophy accompanied by a secretion of milk. This development

in the infant is explained by the presence in its circulation of the same substance or substances that produce breast hypertrophy and secretion in the mother.

Though rare, there are also many instances of infantile hypertrophy, which are rather a manifestation of precocious sexual development than of a localized disturbance of the breasts. In many cases these are due to a disease of the suprarenal glands, hypernephroma, or benign tumors of the suprarenals.

Lebeau reports the case of a baby girl who at birth had a hairy mons veneris and well-developed breasts and began to menstruate in

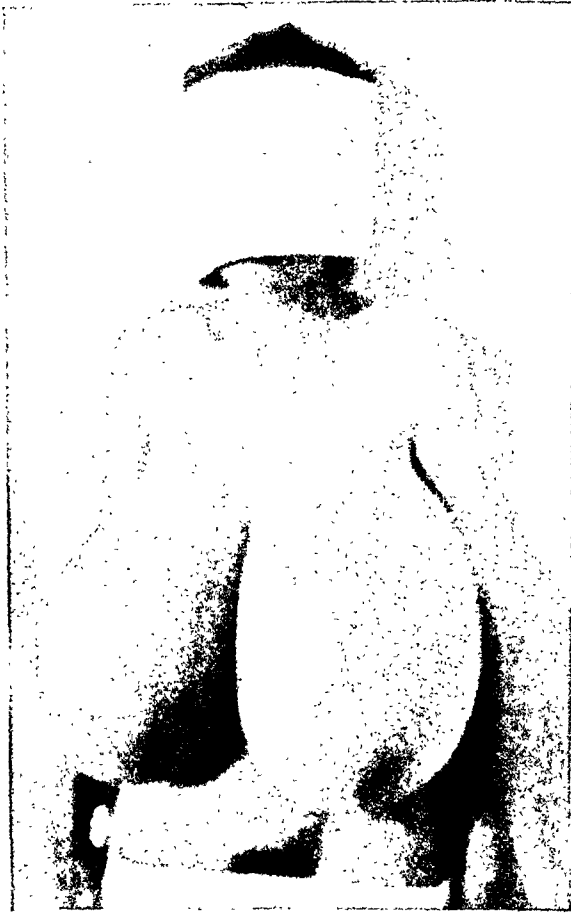


Fig. 1.—Shows the enormous enlargement of both breasts which reach almost to the pubes.

her third year. There are even more remarkable cases of which Deaver and McFarland have several references.

There is no parallelism between these cases of precocious development and those of simple massive hypertrophy in which the breasts are distinctly abnormal. Frank has shown that when once established, ovulation and genital hypertrophy persist; what causes the initial stimulus is still a question.

The description of the breast in massive hypertrophy has been aptly given as showing nothing abnormal excepting the size. In this con-

dition of simple hypertrophy there is a hypertrophic increase in both the glandular parenchyma and interglandular stroma, the preponderance being in favor of the latter. In some instances the parenchyma tubules are dilated and lined by cuboidal cells. Albert has found a diminution of elastic tissue. In a few there has been a preponderance of fat. Guthrie and Albert suggest that this is a different process from hypertrophy, and call it adiposity.

In cases of simple or massive hypertrophy the histories are very similar, a young girl before or at the beginning of menstruation observes one or both breasts commencing to enlarge. Instead of



Fig. 2.—Cross section of breast showing distinct nodules situated in the mammary tissue.

ceasing when normal growth is reached, one or both continue to grow until so large that the child is embarrassed by their size, or the weight becomes so great that walking is interfered with. Discomfort and fatigue are common complaints; in comparatively few is real pain a factor. The enlargement may occur at any time from puberty to the menopause. Deaver and McFarland state that about one-half of the cases reported have occurred prior to the eighteenth, the majority of these around the sixteenth year. The average maximum growth period in the young is twenty months, while in those over twenty-one, it is around five years. The rate varies, however, and there are in-

stances of very large growths in a few months. Zurakoff's patient's breasts reached a circumference of 57 and 58 cm. in two and one-half months.

The size of the breasts may be tremendous. The most remarkable case was reported by Durston in which the left breast weighed sixty-four pounds, the right forty.

In 182 cases in which details were given, the hypertrophy affected both breasts in 142, one breast in 40.

Secretory activity in cases of hypertrophy is variable. Freund's patient, with a tremendous pregnancy enlargement of the breast, failed to lactate, while cases reported by others showed good secretion of milk following pregnancy hypertrophy. Ehrenhaus reported an



Fig. 3.—Microscopic section of nodule showing acini lined by epithelium in a stroma of connective tissue.

instance of hypertrophy in a nonpregnant multipara with as much as a quart of milk a day. There does not seem to be any relation between the size of the breasts and the amount of secretion.

The general tendency for massive hypertrophy is to undergo retrogression. This is especially true in those women who bear children. There are many cases reported of spontaneous regression to normal or almost normal size. This is shown in individuals who refuse operation, or in some from whom the larger breast has been removed, when after an interval of about a month the other diminished to such an extent as to indicate recovery. A knowledge of this experience leads to a conservative attitude and gives the patient who is not actually suffering from her discomfort, a chance of recovery without surgery. In those in whom the breasts are so large and heavy as to interfere

with work or walking, or who are made conspicuous and sensitive by their great size, the breasts may be removed. The existence of pregnancy is not a contraindication. Deaver and McFarland speak of four cases in which the operation was performed at this time without interruption of gestation.

The operation is easily and quickly done, there is no question of malignancy and suitable plastic flaps may be obtained from the large breasts and an uninterrupted recovery should follow.

Regarding the etiology of massive hypertrophy, heredity is mentioned as a factor in three cases. Pflanz's patient, thirty years of age, had a mother who at one time had a greatly enlarged breast and a brother with a gynecomastia. Cubet's patient, twelve and a half years old, had a massive hypertrophy requiring removal of the breasts. Her mother had had at the same age, the same condition, but in her case the breasts had spontaneously returned to normal. The third instance is reported by Englander in which the breasts of an adult woman were so large that the circumference of the right was 52 cm., of the left 46 cm. This patient's mother had a right breast twice as large as the left.

Velpeau reported a case in which trauma, an unimportant blow with the elbow, was supposed to be the inciting cause. Heredity and trauma are probably unimportant factors.

The cause of the enlargement is naturally one for speculation, though practically all are agreed that an endocrine disturbance associated with the organs of reproduction is the exciting agent; against this idea is the fact that in about one-fifth of the cases, only one breast is affected. This observation seems to be outweighed, however, by the fact that in instances of polymastia the accessory breasts share in the enlargement.

As the production of massive hypertrophy is considered one of endocrine disturbance, it might not be out of place to consider here the process of enlargement of the breast at puberty and during pregnancy, and the formation of milk.

That there is an interrelationship between the breasts and the genital tract has long been known. From birth, the ovaries undoubtedly elaborate a small quantity of female sex hormone, but not in sufficient quantity to exert trophic influences on the immature sex organs. The first ovulation marks the onset of puberty, the ovaries, tubes, uterus, vagina, vulva, and breasts becoming enlarged. With other body changes this hypertrophy ceases within normal limits. There is a recognized relationship between the ovaries and other organs, principally the hypophysis and the adrenal glands, but the influence of one gland on the other is far from being thoroughly understood.

From the few observations made in the human race, it is seen that early castration is followed by lack of development of secondary sex-

ual characteristics, including the breasts. Just before each menstruation some stimulus reaches the breasts which is now thought to come from the corpus luteum. During pregnancy at which time the yellow body is larger and persists, the breasts take on rapid changes with considerable growth.

Herrman demonstrated that a lipid isolated by him from the corpus luteum, biologically and chemically, was identical with a lipid extracted in the same manner from the fresh placenta, and the most characteristic effect he obtained from the lipid extracts was a stimulation of the breasts, even in newborn animals. Frank has recently shown that the endocrine substance is identical in the corpus luteum, graafian follicle, and the placenta. Whether or not the latter organ actually produces this chemical or simply stores it in large quantities, is still a matter of speculation.

With the increased stimulation from these substances, the breast is prepared for secretion, though lactation does not follow until a short time after the birth of the child. Involution of the uterus was once thought to originate the process; its independence of the uterus is shown by the fact that a Porro-cesarean section does not prevent it; that it is not initiated by the expulsion of the fetus is shown by lactation following an hydatidiform mole or dead child. Castration does not prevent lactation; indeed, animal breeders castrate for the purpose of prolonging the supply of milk. It is also independent of nerve supply, as shown by successful transplantation of breasts in animals; furthermore, in human beings lactation results after a complete transverse lesion of the spinal cord.

That hypertrophy is dependent on a hormone is demonstrated by enlargement of the breasts and by lactation in parabiotic animals and in the pygopagic sisters studied in Vienna. (Frankl.)

Halban first claimed that it is due directly to the loss of the placenta that colostrum is changed to milk. Frankl then successfully transplanted placentas into pregnant rats, preventing milk formation; the young rats died of starvation. The transplanted placental growths lived about four weeks and when the same rats became pregnant again, they were able to nurse their young.

A retained placental remnant in the human being has been shown to prevent milk secretion. Stimson reported an example of a patient who had lactated normally with eight previous children, then had a retained piece of placenta, with no milk in the breasts for ten days, when suddenly, with the expulsion of this piece of tissue which was about the size of a lemon, lactation was established.

We have, then, in the placenta a substance which, like corpus luteum, stimulates the mammae for the production of secretion but at the same time inhibits actual milk secretion. Frank states that corpus luteum substance and placental extract (identical substances) stimu-



late the breasts to enlargement, but milk secretion does not follow until they are eliminated by expulsion of the placenta and regression of the corpus luteum.

Whether one internal secretion regulates all breast activities is problematical, and indeed, hypertrophy and even lactation in the human being must be accounted for by some hormone other than that of the corpus luteum. There are instances on record where old women or children before maturity, have taken babies and from the stimulation of nursing, produced milk in sufficient quantities to supply the infant.

Muchanoff has reported a case of bilateral enormous fibroadenoma of the breasts; our case is undoubtedly similar to his. Besides the conditions mentioned, there are cases reported of large breasts due to the presence of intramammary lipoma, and a few instances of true elephantiasis.

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509 REPUBLIC BUILDING.

### SOME DISORDERS OF THE FEMALE SEXUAL FUNCTION OF MENTAL ORIGIN

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THERE are certain disorders of the sexual function in women which arise independently of any organic disease of the organs concerned. These are classed as neurotic disturbances and include amenorrhea, dysmenorrhea, vaginismus, vaginal anesthesia, the vomiting of pregnancy, and possibly some cases of abortion. They may arise independently of any organic disease which can be demonstrated. Textbooks on gynecology refer to these conditions as neurotic, and in the case of menstrual disorders speak as if the disorder is the cause of the neurotic state. Thus, Eden and Lockyer (*The New System of Gynecology*) say, "When normal menstruation causes neuroses, it is our experience that the neuropathic condition is cyclical and only exists in

relation to menstruation. Or again Graves (*Gynecology*, ed. 2, 1918) says, "Of the menstrual irregularities that may produce neuroses, dysmenorrhea is by far the most important."

This, however, is to put the cart before the horse. The modern approach to neurotic conditions, which has been made possible by Freud's technic of psychoanalysis, shows quite clearly that these neurotic disorders of the sexual function in women are really only symptoms in much more widespread mental states which in modern terminology are classified as the psychoneuroses (anxiety hysteria, conversion hysteria, obsessional neurosis). These conditions produce effects which arise from certain mechanisms taking place in the mind, which it will be necessary to discuss briefly in order to understand the way in which the symptoms originate.

Since the patient in whom these symptoms occur is not aware of any connection between the symptom and anything that is going on in the mind, the mechanism at work is unconscious.

It follows, therefore, that any approach to an understanding of these conditions must be made through the mind of the patient, and furthermore that any attempt to do so which does not take into consideration the question of unconscious mental functioning is doomed to failure.

Freud's elaboration of the already existing idea of the unconscious has thrown a great deal of light on these conditions. In order to understand them properly, it is necessary to explain some of the fundamental principles involved in the theory of the unconscious. The disorders which have been mentioned are symptoms of a more widespread psychoneurosis. Every psychoneurosis arises as a result of a conflict in the mind of which the person is not aware, that is, unconscious. The conflict arises in the following way: certain ideas which have been repressed become, as a result, unconscious, i.e., the person is no longer aware of them. As these repressed ideas take the form of wishes, they possess a dynamic energy with a constant urge toward consciousness, with the object of finding gratification.

The constant tendency of wishes which have been repressed to force themselves into consciousness again meets with just as constant opposition on the part of the moral and esthetic forces at work in the mind, which are responsible for the repression.

The conflict begins in earliest childhood when the moral and esthetic faculties are beginning to develop. The wishes which have been repressed are of such a nature as to be incompatible with the moral and esthetic faculties. These wishes are mostly connected with the instincts, the sexual instinct being the chief one that is subject to repression. During the first four or five years of life, the child builds many phantasies around its wishes connected with the instincts, a common one of the little girl being the wish that her father should

give her a baby like the one he gave her mother. These phantasies, which are numerous, become repressed for the reasons given.

There is, however, a particular wish from which the little girl develops many phantasies, which is of special importance in this connection. It is a wish which may lead to the repudiation of womanhood later, with all its serious consequences. The wish originates in the following way. Up to a certain period the little child makes no distinction in its mind between the sexes, anatomically. Owing to lack of knowledge on the subject, the little girl does not conceive of the possibility of any others being different from herself. At some period in early life (first two or three years) she makes the discovery that some people possess an organ (the penis) which she herself lacks. This discovery, usually made in connection with her father, her brother, or some other little boy, has the effect of producing a psychology trauma of varying intensity. She wonders what has happened to herself, and comes to the conclusion that either this organ has been taken away from her, or else it has not grown yet, but will later.

It is a shock, producing various reactions. Children hate to feel that they have been unjustly treated, and in the nursery claim equal treatment for all; for instance, some children exhibit jealousy when a brother or a sister is given a bigger helping of some sweet they like. Envy is then a prominent reaction. The little girl, feeling that she has been deprived of something, tends to become hostile to the more fortunate possessor, and to develop revengeful feelings toward him, with impulses to take the organ away. In this case she accepts the situation but is revengeful. In another she may not do so, but may blind herself to the absence of the penis and create the phantasy of possessing one, thus satisfying her desire to be equal to the man (father, brother) in her imagination. These phantasies become repressed for the reasons already given.

It is a characteristic of repressed wishes, however, that they remain unchanged in the unconscious mind indefinitely. Also, in spite of the fact that they cannot enter consciousness in their original form, they are potent for influencing the individual's behavior, without her knowing that it is being influenced by anything. Hence, we find that the most serious effect of the phantasies connected with this traumatic experience is the repudiation of womanhood.

This repudiation of womanhood may be so strong as to lead to a psychoneurosis of which one of the disorders of the sexual function mentioned may be a symptom. The repudiation of womanhood is for the most part an unconscious process. We find women who repudiate it entirely by adopting openly a masculine attitude toward life. For the most part, however, this repudiation is only partial, so that we meet women who outwardly appear feminine but who nevertheless possess strong masculine desires of which they are not conscious, but

which are clearly seen in their characterology when looked for. Such women are usually envious of men. They feel that men have an advantage over them. They are usually hostile to men, try to disappoint them, and are strong supporters of women's rights movements. Their marriages are frequently not successful; they cannot give themselves up fully to occupy the feminine rôle, either in the sexual act, or in their general relationships with their husbands. Although they would like to love, they feel an incapacity to do so, because their positive love feelings become immediately counterbalanced by the hostile feelings which spring from the unconscious repressed wishes. Now it is just the repudiation of womanhood which is the cause of the disorders mentioned.

Every neurotic symptom has one or more meanings in the mind. In other words ideas may be converted into physical symptoms. The ideas which are being expressed are derived both from the unconscious wishes which have been repressed, and from the faculties (moral, etc.) which have brought about repression. Hence, the symptom represents a compromise between the rejected idea and the forces which have rejected it. They are both permitted a certain amount of expression in the symptom.

Disorders of menstruation brought about in this way are extremely common. Amenorrhea, for instance, may be a neurotic symptom due to the repudiation of womanhood. The following cases may illustrate this.

CASE 1.—A young woman who came for analysis for a neurotic condition, suffered from primary amenorrhea until her twentieth year. Examination by a gynecologist showed perfectly healthy organs. The girl was well built, strong, healthy looking, and with excellent color. The analysis proved that she began to menstruate only when the increasing claims of womanhood began to dominate the situation more and more. As a girl she had been very much of a tomboy; she preferred the society of boys to that of girls. She was very envious of a brother in whom as a child she had discovered the penis, and could not bear him to do anything which she herself could not do. She grew up very scornful of men and felt great hostility toward them. She wore coats and skirts with collars and ties, low-heeled shoes like a man, and carried a heavy stick. When, however, her feminine feelings were stimulated by the attentions of a cousin, in her twentieth year, she began to menstruate. Prior to this the analysis showed desires which were largely masculine.

CASE 2.—A married woman, aged thirty-five, suffering from insomnia came for analysis. It soon became evident that she was suffering from a severe anxiety hysteria, with symptoms connected with the sexual function. Thus at each period she suffered from severe dysmenorrhea which forced her to take to bed. In addition, she suffered from vaginal anesthesia, being quite frigid in the sexual act. In her general attitude she was strongly masculine, extremely hostile to her husband on the least occasion, and was frequently filled with remorse afterwards, as she could not understand why she was so hostile. A gynecologic examination showed no organic disease of any kind.

Among her various symptoms was an obsessional idea. When she saw a knife, she was filled with anxiety, and felt the impulse to cut her throat. The analysis

showed the impulse was based upon the unconscious desire to cut off her husband's penis. It was in fact a punishment of the talion kind which she felt she ought to suffer. An eye for an eye, a tooth for a tooth. But this wish in reference to her husband was only the repetition of a childhood wish against her brother, two years older than herself, in whom she had first discovered the penis and of whom she had felt intensely envious on this account, and had at that time impulses to injure him. This impulse became extended to all men against whom she felt strong desires of revenge.

Wherever she was she could not bear to feel she was not as strong as a man, and used to vie with them in such things as muscular feats. If she saw a man in the street coming towards her, she would pull herself up and say to herself "I am as good as you are," thereby showing her real feelings of inferiority. She felt weak in her genital organs, and thought a man was strong there. She dressed in rather masculine attire, and refused to wear feminine underwear. As a girl she insisted upon riding a boy's bicycle. The dysmenorrhea proved to symptomatize part of her repudiation of womanhood, based on the childish envy of the penis.

The pain which accompanied each period, and which was also associated with severe depression was just a repetition of the painful psychologic trauma, resulting from her childhood discovery, expressed in this physical form. The blood also repeated the idea to her, which she had formed as a child, that it must have been cut off. When she first menstruated, she was horrified, and ran to her mother saying her genitals had been cut. This phantasy, of course, arose from her childhood impression that the penis had been cut off, a memory which was now unconscious, but which was stimulated every time she menstruated by the sight of the blood. The depression which accompanied each period also proved to be a repetition of her feelings when the trauma was first felt.

The vaginal anesthesia proved also to be a repudiation of her womanhood. It was partly a desire to deny the existence of the vagina, and partly a desire to disappoint her husband. Up to the time of her marriage, she blinded herself to the existence of a vagina. She did not believe, in face of facts, that there was any opening there. After the first coition, she wept bitterly and was intensely hostile to her husband because he had forced her to accept the rôle of a woman, although she was not conscious of her motive for being hostile.

The analysis resulted in a complete change in her character. Vaginal feeling was restored, so that she enjoyed the normal orgasm, and her dysmenorrhea with its attendant depression completely disappeared.

CASE 3.—A married woman, thirty-nine years old, came for analysis for the suffering caused by obsessive thoughts that her son, aged fifteen, would die. Here again the analysis showed a strong repudiation of her womanhood based on the same idea. She also could not love her husband, though she wanted to do so. He had forced her to accept the rôle of womanhood by the sexual act, which again provoked feelings of hostility to him. She was quite frigid in coitus, and when a baby was born, she wept bitterly and refused to look at the child or to suckle it. Only after weeks would she take any notice of it. She wished it would die. Her fears later for the boy's death were really based on her original desires that he should die. Here again she suffered from dysmenorrhea and intense depression at her periods, which were proved to originate in the same way as in the previous case, and disappeared completely in the analysis.

When there is no organic disease present, vaginismus is usually recognized to be a purely hysterical manifestation. In the analysis of such cases it is always found to depend upon the repudiation of the

feminine rôle. Abraham\* mentions a case where the patient suffered from hysterical adduction of the thighs whenever her husband attempted coitus. This symptom disappeared during the analysis, to be replaced by a defence in the form of vaginismus which also finally disappeared in the analysis.

In Case 2 the patient also suffered at times from vaginismus. It was found to be due to a desire to disappoint her husband, and also represented a phantasy of pinching or crushing his penis, thus being an unconscious repetition of her feelings toward her brother as a child, and had the same significance as her impulse to cut her throat.

All cases of hysterical vaginismus which have been analyzed show the same motive at work, namely, the repudiation of the feminine rôle. Pseudocyesis is generally recognized as representing a wish for pregnancy. In other words, the wish is capable of producing a remarkable condition, outwardly resembling pregnancy. If a wish can be so potent in the one direction, may it not be in the other also? In other words, may not these cases of abortion for which no organic reason can be found also be due to the wish to repudiate the feminine rôle? I have no experience of such cases in analysis, but the vomiting accompanying pregnancy with such varying intensity can certainly be shown to depend largely on the rejection of pregnancy. The vomiting then expresses the desire to get rid of the child in the oral way. The reason for this is that the phantasy so often created by the child is that something has to be eaten to produce the child. Hence, in order to get rid of it, the woman must vomit. This may take place in women who consciously want a child, because the motivating causes are unconscious.

The importance of the repudiation of womanhood is seen to lie not only in its effects upon the woman herself, but also in the reactions it brings about in her husband, often ending in a complete failure of the marriage. Again the children of such mothers, as a result of the environment they are brought up in—the quarrels between the parents which ensue—and the lack of love which the child feels, and so much needs, are more than likely to be neurotic.

27 NOTTINGHAM PLACE.

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\*International Journal of Psychoanalysis, III, part 1, p. 16.

# GESTATION IN A MONKEY (*MACACUS RHESUS*) AND ASSOCIATED PHENOMENA

BY CARL G. HARTMAN, PH.D., BALTIMORE, MD.

(*From the Department of Embryology, Carnegie Institution*)

THE present paper places on record what is believed to be the first exact observation on the length of gestation in a monkey—in fact, in any primate other than man. The subject was, moreover, thought to be of interest to the readers of this Journal because of certain collateral observations on the normal menstrual cycle, on the fertile period within the cycle, and on some entirely new phenomena accompanying pregnancy.

## HISTORY OF THE MOTHER

Our female monkey, No. 2, the mother under consideration, arrived from India along with a thousand other macaques in March, 1925, and was acquired by us the following October. When she landed, she was in possession of a three or four weeks' old baby, which was born during the ocean voyage. The baby died during a cold snap soon after arrival at Nashua, Vermont. The following summer she was kept out of doors in company with numerous other monkeys, including our male, a monkey which we also purchased at the time and by which the fertile mating to be reported below was effected. It is significant that, despite free access to the male during the summer, she remained sterile, but this is a matter that relates to another series of observations which are in progress.

Monkey No. 2 is a vigorous, twelve and one-half pound female, of even disposition, and is at least seven years old. She has never been sick or "off feed" since joining our colony.

## THE NORMAL MENSTRUAL CYCLE

For two years the menstrual cycle of the monkey in question has been followed and found to be about a lunar month—nearly twenty-six days, to be exact, or 11 cycles from June 30, 1926, to April 8, 1927. During this time she was as "regular" as women often think they are. On the exact length of the menstrual flow observations are lacking, since examinations were not made daily, but usually only three times a week. However, no menses lasted over five days, and seemed to be usually less.

The progress of the menstrual cycle was followed by an examination of the cell content of the vagina, not usually by the well-known method of dry, stained smears which has proved fruitful of results in the study of cyclic changes in other mammals, but by a somewhat more instructive method, the "lavage" method, as we may designate it, which seems better adapted to quantitative study.

A "lavage" is made by washing out the vagina with a given quantity of physiologic salt solution (2 c.c. in the case of small, 3 c.c. of

large females). This is placed at once into a graduated tube (a graduated Wassermann centrifuge tube with long narrow stem is convenient) and allowed to settle for two hours. The amount of sediment is then read and recorded in terms of percentage of the total fluid recovered. The sediment consists chiefly of cornified cells desquamated from the vaginal wall. The periodic fluctuations in the present case are plotted in dotted lines on the accompanying chart.

After the lavage is again mixed, a sample is further diluted and methylene blue is added. Two c.c. of the sample added to 6 c.c. of salt solution with 2 drops of 1:2000 methylene blue is a convenient proportion. The methylene blue serves to differentiate the leucocytes into two classes, usually without transitions: those that remain absolutely unstained, and those whose nuclei stain an intense blue. A drop of the dilution is transferred to a blood counting chamber and the absolute number seen within the ruled area (0.1 c.c. volume) recorded. The procedure is the same each day and each animal has its own pipettes and measuring tube so as to reduce possible variables to a minimum.

It will be observed from the chart that the leucocyte count drops to nearly zero in the interval; the curve of greatest desquamation from the vaginal wall rises to a maximum in the latter part of the interval, to fall, usually very low, about the time of menstruation. By means of daily washes it is possible often to note the imminence of menses several days in advance. These observations corroborate Corner's description of cyclic changes in the monkey vagina, as published in his pioneer work of 1923. It is important for the reader to note the cyclic changes as shown in the accompanying chart in order correctly to evaluate the interpretations of results as set forth below.

#### MATINGS

The chief reasons why accurate observations on the length of the gestation period in apes and monkeys are still lacking are these: first, primates have no definite "heat" periods but copulate at any time, some species with great frequency; and second, males and females are usually caged together continuously over long periods. In the present case, matings were made only on certain dates recorded in the protocol. The first three matings were made with reference to the female's sex behavior in relation to other females or to an immature male kept in the same cage. Latterly, however, the matings were entirely with reference to the menstrual period and the vaginal examinations. The matings were as follows:

With Male A, Nov. 19, 1925, second day after cessation of menses.

With Male A, Dec. 14, 1925, twentieth day of cycle (a cycle is considered as beginning with the onset of menstruation).

With Male A, June 4, 1926, twenty-second day of cycle.



With Male D, Sept. 1, 1926, sixteenth day of cycle.

With Male D, Feb. 1, 1927, fourteenth day of cycle; leucocytes practically zero, had been decreasing for several days.

With Male D, March 1, 1927, thirteenth day of cycle; leucocytes practically zero, had been decreasing for several days.

With Male A, April 16-19, 1927, ninth to twelfth day of cycle; leucocytes on the decline, but not yet zero.

The last mating is regarded as the effective one, inasmuch as it is the only mating that was followed by any changes other than those appertaining to the normal menstrual cycle, as will appear from an inspection of the chart; indeed, two menstrual periods followed the last infertile mating.

In this connection, attention might be called to the temporary vaginal leucocytosis following the matings. Whether the introduction of foreign proteins ("spermatotoxins" or other compounds of the complex semen) into the vagina constituted the stimuli for the migration of the leucocytes remains a problem for further study.

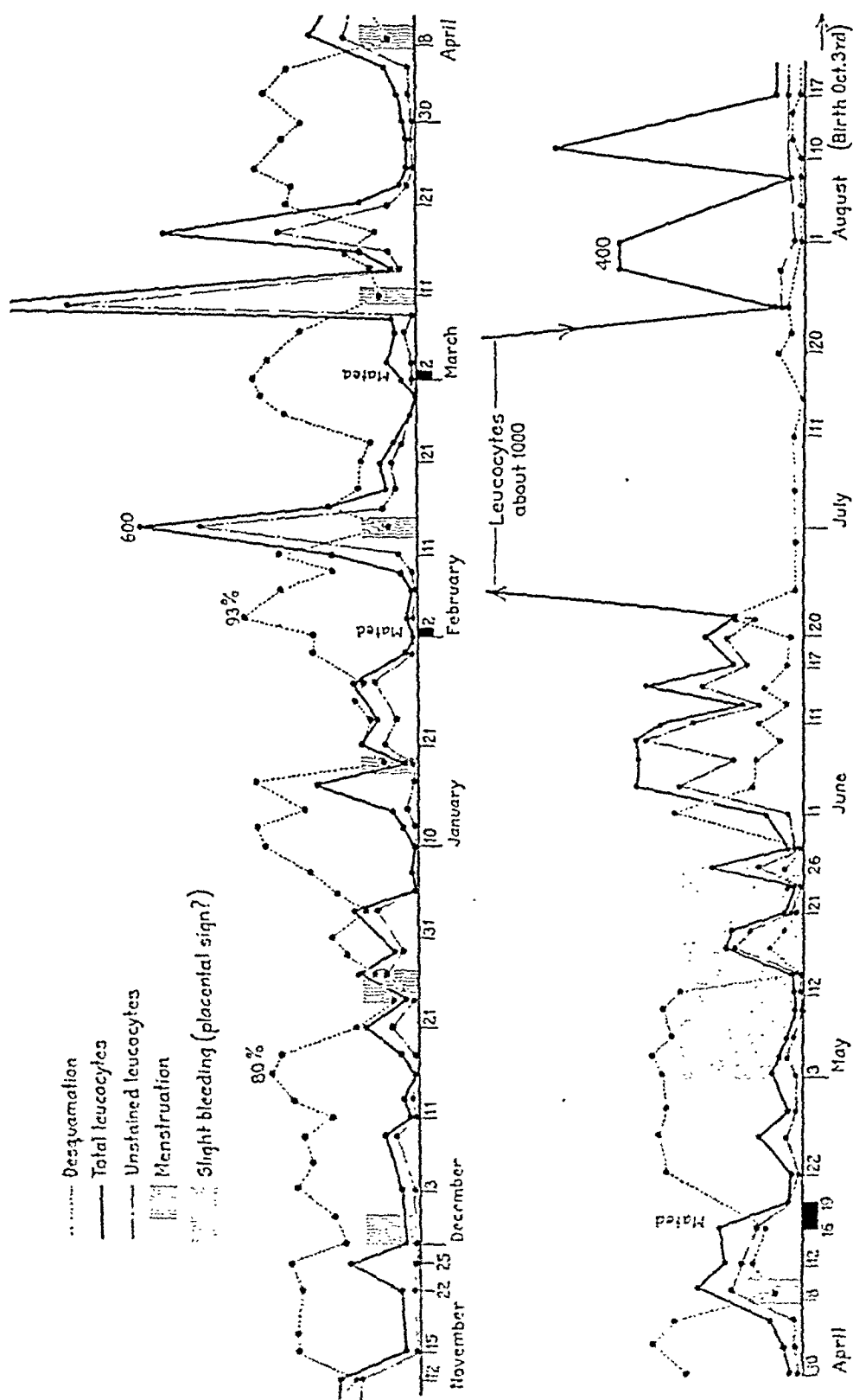
#### THE FERTILE PERIOD OF THE CYCLE

It is now generally accepted by gynecologists that in the human species the optimum period for conception is about ten to fifteen days after the beginning of the menstrual flow. In the monkey, Corner (1923) records the recovery of a tubal ovum on the fourteenth day, a uterine ovum on the seventeenth day of the cycle; Allen (1927) recovered one tubal ovum on the tenth, another on the fourteenth day of the cycle. One of my own monkeys died suddenly of pneumonia on the eleventh day of the cycle; two freshly ruptured follicles were found in the ovary.

In the present case, the last mating is the only one of the seven matings which falls within the ovulation period of *Macacus rhesus* as thus far determined. Furthermore, it took place not after, but just before the leucocyte count dropped to zero. Considering the three last matings together, one is led to infer that the ovum cannot wait long for the spermatozoa, a conclusion quite in line with the growing evidence that the mammalian ovum is extremely short lived (Hartman, 1924, Grosser, 1924, 1927). There is no doubt that the disappearance of leucocytes from the vaginal smear is due to follicular hormone (see Allen, 1927, for bibliography); hence, one would expect ovulation to occur about the time the leucocytes reach zero. An inspection of the chart, however, would seem to indicate a short lag or refractory period in this regard.

#### THE VAGINAL LAVAGE DURING PREGNANCY

The last menstruation before the fertile coitus occurred April 8; it had not begun on April 5; on April 12 there was no longer a trace of the menstrual flow. We may conservatively set the beginnings of



the flow, the onset being usually gradual, on April 7, though it may well have been April 6. On May 3, about the time of an expected new period, a few red blood cells were to be seen in the vaginal lavage, and this continued for each of the eleven examinations until May 26, a total of twenty-three days. The bleeding was always very slight and was never visible externally. On May 14 the protocol contains the entry "many reds"; on May 3, "several reds"; on May 19, when the leucocytes numbered 164 in our arbitrary unit, the erythrocytes numbered 20.

The presence of erythrocytes in small numbers early in the formation of the placenta recalls the discovery by Long and Evans (1920) of the "placental sign" or "erythrocyte sign" in the rat; that is, when implantation takes place, and only then about the fourteenth day of gestation, the vagina contains microscopically demonstrable red blood cells. Their appearance is explained by Evans and Burr (1927) as due to slight leakage from the developing placenta. If in the present case ovulation and fertilization occurred April 19, the ovum was fourteen days old when the bleeding began and entering the sixth week when it stopped. Whether the observed bleeding really constitutes a "placental sign," that is, a genuine and very early sign of pregnancy, is devoutly to be wished, though, of course, by no means proved by the single case. A number of fine old macaques are on hand to test the theory further. It is needless to suggest that the clue be followed by gynecologists in human cases.

Following the cessation of the "placental" bleeding, a long continued vaginal leucocytosis ensued, as may be seen from the chart. The meaning of this is not clear. Unfortunately, there are no observations on the vaginal content after August 17, inasmuch as it was thought best to disturb the animal as little as possible; hence it is not known whether or not the leucocyte content of the vagina returned to normal. If one were allowed an opinion, it would be in favor of a low leucocyte count in the later stages of pregnancy due to the absorption of placental hormone, evidence of the presence of which is to be seen in the exacerbation of the sex color during pregnancy, as will appear below.

After June 15, there are a number of entries in the protocol of mucous shreds appearing in the lavage. This accords with findings in human pregnancies.

The cells of Papanicolaou (1925), supposedly diagnostic of pregnancy in women, were looked for and are recorded in the protocol by a number of entries from June 1 to August 17. They are bizarre epithelial cells as described by Papanicolaou: linear, lunar, and boat-, club-, and horseshoe-shaped. I doubt, however, whether these cells are characteristic of pregnancy as such; but I suspect that they are a mark of amenorrhea whether that be due to pregnancy or to other

causes. I can make the same statement for the opossum. The matter will be studied more intensively on other occasions.

#### OTHER PHENOMENA ACCOMPANYING PREGNANCY

The first attempt to palpate the fetus was July 20. On August 5 the head seemed to be about 30 mm. in diameter. On August 19 the fetus could be felt in its entirety and was active. It had the "head presentation" position. On September 12 and again on September 19, the "bruit placentaire" could be heard with the stethoscope on the right side; on September 26, however, the audible point had shifted to the midventral line.

Observations on the sex color of the mother are of interest from an endocrine standpoint. The color change on the female's hips and buttocks (the "sex skin") during pregnancy was not so striking because she happens to be a female that always has a very livid sex skin which blanches but slightly at about the menstrual period (Collings, 1926). The red color, however, comes and goes in a striking menstrual wave at other regions which are red only in the interval, namely the face, the nipples, the thighs below the sex skin, and the calves to the heel. In this brilliant condition she remained throughout gestation, at least after July 8 when the point was first written down in the protocol. Some days after parturition the color had decidedly decreased.

This periodic reddening during the interval of the menstrual cycle is attributable to the follicular hormone, as proved experimentally (Allen, 1927); during gestation, to the placental hormone. So far as we know now these two hormones are identical. This reddening of the female monkeys to the maximum intensity I have seen in more than a dozen pregnant monkeys that have come to my notice.

#### THE PERIOD OF GESTATION

Cuvier, in the second edition (1828) of his famous book, "Le Règne Animal," states categorically (p. 116), "leur gestation dure sept mois" and in a footnote quotes one Élien who observed the parturition of a monkey in India. No details are given, but the statement is quoted by writers throughout the century. Selater (1900, p. 9), speaking of *Cercopithecus lalandii* (vervet monkey) says: "The period of gestation does not seem to have been recorded, but that of an allied form, the malbrouch (*C. cynosurus*) is stated by Babu R. B. Sanyal, of the Calcutta Zoological Gardens, to be seven months." Bluntschli (1913) estimates the duration of pregnancy for *Cebus* and *Chrysotrrix*, New World monkeys, as four and a half to five months. None of these statements is supported by satisfactory evidence.

In our own case the baby was born during the night of October 2-3. The period of gestation is therefore almost exactly six lunar months.

No afterbirth was found in the cage; hence the assumption is that this was eaten by the mother. There were numerous small blood stains on the floor of the paddock.

#### SUMMARY

1. The length of gestation in the case of *Macacus rhesus* described in this paper was almost exactly six lunar months. This is the first authentic record of gestation in any primate except the human being, so far as we know.

2. The fertile mating took place between the ninth and the twelfth day after the beginning of the last preceding menstruation, whereas six other previous matings outside this period had been ineffective.

3. A slight bleeding, presumably from the immature placenta (the "placental sign" of Long and Evans), microscopically demonstrable, occurred from about the fourteenth to the thirty-seventh day of gestation. This phenomenon may furnish a clue to the very early diagnosis of pregnancy in human beings.

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### AN ANALYSIS OF THIRTY-TWO CASES OF ECTOPIC PREGNANCY AND THREE SUSPECTED ECTOPIC PREGNANCIES\*

BY EDWARD ALLEN, M.D., CHICAGO, ILL.

THE recognition of ectopic pregnancy is probably the most urgent factor in differential diagnosis which confronts the gynecologist in his daily practice.

We have attempted in this small series of cases to analyze critically the important details of history and treatment in order to ascertain if a correct diagnosis is possible, short of laparotomy, in those patients presenting typical ectopic histories and palpatory findings but having some other condition to account for their clinical picture.

It is usually not difficult to diagnose extrauterine pregnancy after rupture has occurred and the patient presents the definite symptoms

\*Read at a meeting of the Chicago Gynecological Society, May 20, 1927.

of marked intraperitoneal hemorrhage. However, if we are to save the patient this dangerous loss of blood and operate while easy conservative surgery can still be done, it requires a more refined method of diagnosis and technic.

Fortunately, few if any ectopic pregnancies rupture without previous symptoms, which are usually of sufficient severity and duration to cause the patient to seek medical advice before rupture occurs. Many of these patients are sent home or to a hospital for observation until an acute rupture makes prompt attention imperative. Yet, if all cases of suspected ectopic pregnancy are operated upon early by laparotomy, many will prove to be complicated early uterine pregnancies, corpus luteum cysts or simple cystic ovaries.

The cases reported here have been operated upon in the Presbyterian Hospital, Chicago, on the service of Dr. N. Sproat Heaney. We have included for comparison in detail of history and treatment five rather advanced cases with marked intraperitoneal hemorrhage. These patients either sought treatment late or were referred by other doctors and were operated upon as soon as admitted.

*Age and Previous Pregnancies.*—In the cases of ectopic pregnancy the average age was 30.8 years; the youngest 18 and the oldest 41 years. More than one-half were 30 years or over. Sixteen had not been previously pregnant. Nine patients had given birth to one or more full-term children. Four patients had been pregnant but had aborted during the early months of pregnancy. If we include these four cases of abortion and the three who had a previous ectopic pregnancy, it raises the percentage of relatively sterile cases to 71.7 per cent. Twenty-two of these patients had been married three years or longer. Two were unmarried.

We feel that relative sterility is an important equation in the cause, diagnosis, and treatment of ectopic pregnancy. The same factors whether they be infection, infantilism or some interference with the descent of the ovum, undoubtedly predispose to ectopic implantation as well as to relative sterility.

The diagnosis of extrauterine pregnancy becomes more probable in a patient complaining of irregular vaginal bleeding and cramp-like pains in the lower abdomen if they are associated with a history of relative sterility. Since so many of the patients have not borne children, we must diagnose and treat them early before tubal and ovarian damage has become too marked.

*Menstrual Data.*—Where the complete menstrual history was available most cases were normal according to onset, type, duration and pain; 89.9 per cent began to menstruate between the ages of eleven and fourteen years. Only two began late, one at eighteen years and the other at nineteen years; 80.0 per cent were regular, 19.2 per cent irregular in their menstrual habits. Only one of the patients com-

plained of severe dysmenorrhea and that was the patient who began to menstruate late, when she was eighteen years old. The rest described the pain as slight or none at all. A little more than half gave no history of dysmenorrhea. If infantilism is associated with late onset, irregular habit and dysmenorrhea it does not seem to be an important causative factor in this group of extrauterine pregnancies. In only two cases was definite record made at the time of operation that the uterus was smaller than normal.

One-third of the cases with exact last menstrual period dates had not missed a menstrual period but began to spot on or before the expected time. One patient began to spot seven days before her expected date, another two days before. Two additional cases had two days, one, three days, and two others five days of amenorrhea. These last discrepancies are within the variation limit of any normal menstrual cycle. Irregular bleeding or spotting was the most constant symptom present, more so than pain.

Thirty out of thirty-one of these patients had irregular vaginal bleeding for a period of from five to sixty-seven days. The average was 30.4 days. Only one case had a complete amenorrhea which lasted sixty-two days, until she was operated upon. Two of these cases of bleeding bled as much as a regular menstrual period at any time during their relative amenorrhea. This bears out the usual teaching—the more profuse the bleeding the less probable it is we are dealing with an extrauterine gestation. All the patients were questioned very closely about the onset of this bleeding, as we feel it is one of the most important elements in a correct diagnosis. *Practically all* these patients in whom bleeding occurred at or about the menstrual time spoke of it at first as their last regular period. They did not realize that the amount and duration was different from that of their usual flow until asked specific questions.

*Pain.*—The usual lancinating textbook pain was conspicuous by its absence in all but two cases. One of these patients described it as a knife-like stab in the side associated with fainting, which occurred four days before operation. She had a fetus of three and one-half months' size extruded into a large walled-in blood clot in the region of the left tube. The other had an ectopic pregnancy in the right tube 8 cm. in diameter which had eroded one of the larger vessels and the abdomen was filled with old blood.

Severe cramps in the lower abdomen occurred in 31.2 per cent, two with associated pain in the thigh and leg. All these patients had free blood in the peritoneal cavity. Two cases, however, did not give a history of any discomfort, but came in for irregular vaginal bleeding and both were found to have free blood in the abdomen. Three patients had typical phrenic irritation pain radiating to the shoulder and neck.

Two patients gave a history of passing what may have been a decidual cast. In both instances this was the probable cause in the mistaken diagnosis of uterine abortion. The first patient had been examined by her physician at home. He told her that the tissue passed was a miscarriage, but as she continued to spot she sought further advice. The other patient was a graduate nurse and the wife of a doctor. She stated she had been curetted for an incomplete abortion. She had continued to bleed, however, and felt that the curettage was also incomplete. When the possibility of ectopic pregnancy was suggested to her, she replied that her husband had seen the placenta. In both cases curettage did not reveal sufficient cause for the bleeding but free blood was demonstrated in the pouch of Douglas by colpotomy.

*Blood Changes and Temperature.*—Sixty-nine and nine-tenths per cent of all cases had a leucocytosis of from 10,000 to 20,000. The temperature range in these patients was from 98° to 100° F. The highest admission temperature was 100° and this patient had 7750 white blood cells. The patient with 20,000 leucocytes had a temperature of 98.6° F. and the abdomen was filled with free blood. A definite leucocytosis associated with a temperature of 99.2° or less indicated bleeding into the peritoneum. Twice as many definitely increased leucocyte counts as normal counts were recorded in the patients with intraabdominal bleeding. The lowest hemoglobin recorded was 34 per cent (Dare); average 73 per cent. Only five patients showed definite evidence of loss of blood with readings of less than 70 per cent.

*Operative Procedure.*—Every year we are increasing the number of gynecologic cases operated upon vaginally; this is especially true of ectopic pregnancy. Only four of these thirty-two patients were operated upon by straight laparotomy. A résumé of these four case histories will be given later.

In all the other twenty-eight cases whether straight vaginal or vaginal combined with abdominal incision, the diagnosis was confirmed by the following procedure: The uterus was always first curetted to rule out early uterine abortion or other causes of uterine bleeding. An incision was made in the posterior fornix through the vaginal mucosa and after all bleeding points had been secured the peritoneum was opened. In all but two instances old blood could be definitely demonstrated although frequently only a few drams. In one of these patients the pregnant tube could be palpated through the colpotomy opening and brought into view by tipping the uterus backward into the incision. In the other, adhesions from a previous operation did not permit palpation or allow the small amount of blood found on abdominal exploration to reach the culdesac.

If there seemed to be too much blood in the peritoneal cavity or exposure of the affected side was too difficult, the colpotomy was closed and the abdomen opened; if not, the ectopic sac was removed



through the vagina. We were able to remove nine or 28.7 per cent vaginally. In nineteen patients the diagnosis was confirmed vaginally by exploratory curettage and colpotomy, after which laparotomy was performed.

The earlier the diagnosis is made the higher will be the percentage of cases capable of being treated by vaginal removal. Blood was found in the culdesac in patients where the tubal swelling was no larger than 2 or 3 cm. in diameter.

To many it would seem inadvisable to open an abdominal cavity containing free blood, as a culture media through the vagina. However, our results compare favorably with the patients operated upon by straight laparotomy in this series and in previous years.

The prolonged stay in the hospital of some of the patients was due to other factors than their operative recovery. Many were out-of-town patients and others could not have adequate convalescent care at home.

The highest postoperative temperature was 103.6° F. in a patient operated upon vaginally. This patient has since had a normal full-term pregnancy. The average temperature for the four straight abdominal cases was 101° F.; nine straight vaginal, 100.9° F.; nineteen abdominovaginal, 100.8° F.

The average stay in the hospital of all cases was 17.5 days; of those done vaginally 15 days, and abdominal and vaginal combined 17.9 days.

We have attempted in all these cases to do the most conservative surgery compatible with safety and still leave the patient the greatest possibility for a future pregnancy. In 37.5 per cent only the pregnant portion of the tube was removed and the stump left open. Of these six or 34.6 per cent have subsequently become pregnant. Three of these six went to term and three had a second ectopic pregnancy. These three recurrences were all tubal and of the opposite side. Three of these patients had previously had the tube on the other side removed and have not been able to conceive with the small portion of tube we were able to leave for them. In ten patients there was such destruction of tissue that the whole tube was removed including its interstitial portion.

A bilateral salpingectomy alone or combined with hysterectomy was done in the following five cases:

CASE 1.—Patient was thirty-eight years old and had had one full-term pregnancy. The uterus contained several small fibroids. The uterus and both tubes were removed vaginally.

CASE 2.—Age thirty years. We had previously removed a portion of the opposite tube for ectopic pregnancy. The stump was atrophic and closed. The remaining pregnant tube and fundus of the uterus which contained a fibroid was removed.

CASE 3.—Age thirty-eight years. Patient had had eight full-term pregnancies. The opposite tube was closed and adherent with the corresponding ovary in the culdesac. The uterus and both tubes were removed through the abdomen.

CASE 4.—Age thirty-five years. The opposite tube was closed and adherent. Bilateral salpingectomy was done.

CASE 5.—Age thirty-five years. Patient had one full-term child. The opposite tube was closed and adherent. Bilateral salpingectomy was done.

There was definite evidence of previous pelvic inflammation in 50 per cent of these patients. Notation was made of a recent corpus luteum cyst on the opposite side in four cases and on the same side as the pregnancy in one case.

We wish to include in detail the important facts in the histories, vaginal findings and treatment of the three suspected ectopic pregnancies.

CASE 1.—Age thirty six. Patient had been married eighteen years and had had two full-term pregnancies and one miscarriage. Her menstrual history was normal. The last regular period was July 8, 1921. She began to have irregular vaginal bleeding on August 16, 1921, which continued for twenty-one days and had been accompanied by cramp-like pain in the lower abdomen for the last week.

The blood count showed a leucocytosis of 12,800, erythrocytes 4,170,000, hemoglobin 78 per cent.

In the region of the left ovary was a lemon-sized swelling which was tender on palpation.

Curettage revealed a normal amount of scrapings. Posterior colpotomy was done and several drams of straw-colored fluid escaped, which had come from a corpus luteum cyst of the left ovary.

CASE 2.—Age thirty-two years. Patient was an unmarried woman. Her previous menstrual history was normal. The last regular period occurred March 10, 1926. Amenorrhea had continued for eighty-nine days when she began to spot and have cramps in the lower abdomen. Eight days later we examined her under gas anesthesia but due to very thick abdominal walls and small vagina the examination was unsatisfactory.

The blood count was normal.

On curettage there seemed to be a little more tissue obtained than usual but no evidence of pregnancy. Tubes and ovaries were normal on inspection through a posterior colpotomy incision.

CASE 3.—Age twenty-two years. Patient had been married four months. Menstrual history was normal. Three days after her expected menstrual date she began to spot and have cramps in the right lower abdomen. This continued for two days until she was operated upon.

This patient also had a leucocytosis of 12,900.

Vaginal examination revealed a tender swelling in the region of the right adnexa about two inches in diameter. She was operated upon forty-four days after her last regular menstrual period. We obtained about the usual amount of uterine scrapings on curettage and about two ounces of turbid fluid escaped into the vagina when the culdesac was opened. There was a ruptured corpus luteum cyst of the right ovary.

The histories and vaginal findings of these three patients are typical for extrauterine pregnancy. The correct diagnosis could not have been made except by laparotomy or posterior colpotomy if we are to operate suspected ectopic pregnancies early before rupture has occurred. The treatment and diagnosis were carried out with the minimum of

discomfort and danger to the patient. The results were as accurate as by laparotomy.

Even with this small series of cases we feel we can draw the following conclusions:

1. It is often impossible to differentiate ectopic pregnancy from other pelvic lesions by history and palpatory findings alone.

2. This can be done accurately and with a minimum of risk and discomfort to the patient by diagnostic curettage and posterior colpotomy.

3. Even in cases of little doubt the diagnosis should be confirmed by the above procedure before the abdomen is opened. This procedure does not increase the operative risk to the patient.

4. Diagnosis should be made as early as possible and if findings permit, treatment should be carried out through the vagina.

5. Relative sterility has a definite relation to ectopic implantation.

6. Irregular spotting is the most constant symptom of ectopic pregnancy and pain is the second.

(For discussion, see page 566.)

## THE COMBINATION OF A SHORT MENSTRUAL CYCLE AND DELAYED COITUS AS A FACTOR IN STERILITY

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(From the Department of Obstetrics and Gynecology, College of Physicians and Surgeons, Columbia University)

THE following two cases demonstrate that a short menstrual cycle, combined with delayed coitus, the latter often due to religious beliefs, are factors in the etiology of sterility.

CASE 1.—Mrs. H. R., Jewish, came to my office on December 6, 1922, with a complaint of sterility of two and one-half years duration. She had had no previous illness, no operations, no miscarriage. She had been married two and one-half years. Menses began at fourteen years, every twenty-four days, three days in duration, moderate in amount. She had no pain during periods. Since marriage the periods have been the same. Last period November 19, 1922. During the period, between the tenth and fourteenth days from the onset of the menstrual flow, at each menstrual cycle, the patient experienced a pain low in the pelvis which lasted about twelve hours. The pain was either on one side of the pelvis or the other and frequently alternated with each cycle. Occasionally she was overdue a day or two, and when that occurred, she passed clots and had moderate cramps. This occurred five or six times during the last two and one half years. The patient never used contraceptives. Venereal disease was denied. No leucorrhœa.

The patient was a wiry young woman in good health. A general examination was entirely negative.

Pelvic examination showed the internal genitals negative, the parametria negative, and the tubes patent by the Rubin test. A condom specimen showed a normal number of sperm. No abnormal forms. The blood serum test did not agglutinate spermatozoa.

The treatment included placental extract, gr. 5, t.i.d., mammary extract, gr. 5, t.i.d., the purpose of which was to attempt to change the twenty-four day menstrual cycle to a twenty-eight day type. It subsequently proved unsuccessful and was discontinued because of palpitation of the heart.

Last period occurred December 15, 1922, one day overdue, clots, and pelvic pain upon passing clots. Physical findings the same.

A chance remark on the part of the patient disclosed the fact that she was deeply religious. Further questioning brought out the admission that she followed an old orthodox Jewish custom of waiting two weeks after the menstrual flow was over before coitus was attempted, so that the first intercourse in each menstrual cycle occurred about eighteen days after menstruation or about six days before the onset of the next period. In view of the possible bearing of this abstinence on her sterility, I advised her to begin intercourse one week after the onset of her flow. This she refused because of religious scruples. This advice was given on March 6, 1923. All medication was then discontinued. Immediately following her menstrual period of May 9, 1923, she decided to accept my advice, and began intercourse several days after the flow stopped. (This for the first time since her marriage.) She had no further periods following the above and when seen on July 25, 1923, she was two months pregnant.

CASE 2.—Mrs. F. M., Jewish, married two years, sterile. Menses every twenty-six days, three to five days in duration, moderate in amount. Dysmenorrhea before marriage and slight discomfort since.

A general physical examination revealed no abnormality of either the system or the pelvic organs. The tubes were patent. Spermatozoa were numerous, and there were no abnormal forms. The husband's semen digested the patient's cervical mucus completely within twelve hours.

A further inquiry into the patient's history disclosed that she also observed the custom\* of waiting two weeks after the menstrual flow was over before intercourse was attempted, so that the first coitus of each month occurred about eighteen days after the onset of the flow or about eight days before the beginning of the next period. She was advised to begin intercourse one week after the onset of the flow. The patient readily consented. She carried out my advice during August, 1926 and again during September, 1926. There was no medication. Her last period was September 15, 1926, and she is now in her ninth month of pregnancy.

The first case can be considered best in the light of recent studies as to the relationship between menstruation and ovulation. R. Schroeder<sup>5</sup> believes that for the twenty-eight-day menstrual cycle, ovulation occurs between the fourteenth and the sixteenth day, counting from the first day of the last menstrual period. Small variations occasionally occur. According to the researches of L. Fraenkel<sup>1</sup> ovulation in the twenty-eight-day menstrual cycle occurs between the eighteenth and nineteenth day, counting from the first day of the last menstrual period. According to Fraenkel when the menstrual cycle is shorter, i.e., every twenty-four days, ovulation occurs earlier, about the eleventh day following the onset of the last period.

The recurrent intermenstrual pain which the first patient complained of was most likely due to ovulation (E. Novak<sup>6</sup>). Schroeder

\*Note: It is interesting to note that both patients misinterpreted the old Talmudic Law on this matter. The law states that after all signs of menstruation have disappeared, the patient must wait full seven days before coitus can be attempted. Should the patient spot at any time during the month, she must again wait seven days before attempting coitus.

also believes that this "Mittelschmerz" is due to ovulation. This, then, would fix ovulation in the first case to the period between the tenth and fourteenth day following the onset of the last flow. This agrees very well with the findings of Fraenkel. Supposing this patient ovulated on the eleventh day of her twenty-four-day menstrual cycle, and coitus first took place on the eighteenth or nineteenth day; then allowing twenty-four hours for the sperm to reach the ovum, the nineteenth or twentieth day has been reached. The question then is whether the ovum can be fertilized at this time.

This brings up the problem as to the duration of life of the human ovum. Schroeder believes it is from twelve to fourteen days, that is, the ovum dies just before the onset of the next period. Graf Spee<sup>6</sup> states that the duration of life of the human ovum is unknown. In lower forms, such as the rat and mouse, the ovum dies after twelve hours, according to Long.<sup>2</sup> Graf Spee is therefore inclined to believe that the life of the human ovum is very short. Neither Schroeder nor R. Meyer<sup>3</sup> bring up any proof to demonstrate the long life of the human ovum. It is more than likely that in Case 1 when the sperm reached the ovum, the latter was no longer fertilizable. The fact that the patient occasionally went over a day or two and passed clots could be explained by assuming that fertilization did occur, but as the viability of the ovum at this late date was diminished, the fertilized egg degenerated and menstruation came on again.

Case 2 presents a somewhat similar picture. Assuming that with her twenty-six-day cycle, ovulation occurred on the twelfth day, coitus on the eighteenth or nineteenth day, the sperm first came in contact with the ovum on the twentieth day. It seems quite reasonable to suppose that by this time the ovum was no longer viable and fertilization did not occur.

The advice to begin coitus on the seventh day of each cycle in both cases led to immediate conception in Case 1 and to almost immediate conception in Case 2. It would appear from this that the duration of life of the ovum is short, that its viability is greatest just after ovulation, and that viability diminishes as we proceed further away from the date of ovulation.

How frequently the combination of a shorter menstrual cycle and delayed coitus occurs, I am unable to state. In my limited experience I have observed only these two cases.

## REPORT OF A CASE OF ERGOT POISONING POSTPARTUM\*

BY H. LEO MOSKOWITZ, M.D., NEW YORK, N. Y.

(Associate in Obstetrics, Jewish Maternity Hospital)

A SURVEY of the literature as far back as 1900 shows the paucity of cases of ergot poisoning.

The toxicology of the drug as described by Sollman, Cushny, Wilcox, Underhill, Peterson, and others is familiar. O'Gorman's patient had been taking drachm doses of ergot every four hours in order to induce menstruation. After some time she became giddy, fainted, had a convulsion, and lapsed into coma. Pulse 58, weak and small. There developed severe tonic contraction of the flexor muscles of the forearm, thighs, and leg. She was unconscious for three days. Contractions kept up at indefinite intervals. Patient recovered.

H. W. Emsheimer described a case of tetany in a female adult. The patient, single, having passed her period three days, took a large dose of ergot and continued its use in drachm doses every two hours for five days. She did not abort. Two days from date at which the ergot was discontinued, she was suddenly seized with severe epigastric cramps, with nausea and vomiting, and passed into a semi-delirious and restless state. This was followed by rigidity of all extremities and a typical bilateral carpopedal spasm. Patient recovered.

W. J. Stewart McKay reported a case of gangrene of the fingers, following the administration of ergot. The patient, a para v, aged thirty, had missed a period and obtained a twelve-ounce bottle of ergot with the idea of inducing abortion. She took one tablespoonful three times daily for one week, and as there was no result, she waited three days and obtained a second bottle which she finished in a week. She had not aborted. Before she had entirely finished the second bottle, her arms began to ache, the fingers became swollen, and by and by several of them became gangrenous at the extremities as far as the distal joint. The patient was operated upon one year later.

In the case of Rosenbloom and Schildecker the patient was a young girl who suddenly had been taken ill about an hour after her supper. She was cyanotic, had vomited considerably, and had a rapid pulse. Stimulation brought about recovery. Eleven days afterward, she was found in a serious condition. She was unconscious, and there was suppression of urine. Clonic convulsions occurred, and contraction of the uterus could be noted visually as well as by palpation. Bloody stools, containing pieces of intestinal mucosa, were passed. Death occurred nineteen hours later. Necropsy disclosed a pregnancy and a severe inflammation of the entire gastroenteric tract. Portions of the liver, kidneys, stomach, and intestines were removed for toxicologic examination. Dragendorff's process as described by Witthaus was the method employed. The crystals obtained were compared with some preparations of ergotin and were found to agree in every particular.

It is impossible to estimate definitely the fatal dose of ergot and its preparations, because the preparations vary so widely in their content of the active principles. There is evidence that some patients may even have a certain degree of idiosyncrasy for the drug, as shown by the fact that one fluid drachm of the fluid extract has caused symp-

\*Presented at a meeting of the Section on Obstetrics and Gynecology of the New York Academy of Medicine, April 26, 1927.

toms to appear, while ounce doses have caused no untoward poisonous effects. Gangrene and death have occurred after twelve grains of the extract.

#### REPORT OF CASE

Mrs. B. L., aged thirty-five, para ii, delivered a full-term baby spontaneously four years ago. A laparotomy was done three years ago for retroversion of the uterus. She last menstruated September, 1925. The expected date of confinement was June, 1926. She was highly neurotic. The vertex presented. Fetal heart was heard in the left flank. Blood pressure 120/70. Urine showed a faint trace of albumin. Subsequent antepartum examinations revealed the same findings.

Onset of labor occurred June 11, 1926, at 8 P.M. The patient was admitted to the Jewish Maternity Hospital June 12, 1926 at 2 A.M. The external and internal os admitted one finger, the cervical canal was 1 cm. long, the membranes were ruptured, the vertex presented with a small segment through the inlet, and the fetal heart was heard in the left flank.

Examination six hours later disclosed the cervix to be four fingers' dilated; an L. O. P. position, and the fetal heart in good condition. At 3 P.M. the same day, thirteen hours following admission, the cervix was fully dilated, and the vertex unengaged in the L. O. P. position. The fetal heart was not heard. Pains occurred every three minutes, strong and regular.

Morphine sulphate, gr.  $\frac{1}{4}$ , was given. She delivered a stillborn baby spontaneously on June 13, at 8 A.M. (eighteen hours later). The total duration of labor was thirty-six hours. Weight of baby eight pounds, three ounces. The placenta appeared normal.

On the first day postpartum the rectal temperature was 102.4° F.; pulse 120. She was placed in Fowler's position, an ice bag was applied to the fundus, and one drachm of the fluid extract of ergot given three times daily.

On the fourth day postpartum the uterus was enlarged, soft and boggy. The lochia was foul and scanty. Ergot was continued in order to favor contraction and retraction of the uterus. The temperature ranged from 100° to 101° until the ninth day.

On June 20, the evening of the sixth day postpartum, the patient had a fainting spell of short duration. When I saw her one-half hour later, she complained of coldness, numbness, tingling, and weakness in both the upper and lower extremities. The face appeared cyanotic, and she was slightly dyspneic. The heart was normal. The blood pressure taken on either arm did not register. The picture was one of collapse. The physical examination revealed evidences of a complete disappearance of pulses simultaneously in both radials, popliteals, and dorsalis pedis arteries. The brachial and femoral arteries, however, were not involved. Both hands and feet were cyanotic and cold to touch. Adrenalin and caffeine sodium benzoate were given by hypodermic.

The following day the patient complained of headache, appeared very restless, irritable, and showed symptoms of disturbed mentality. Luminal and morphine were given. She frequently refused nourishment, was nauseated and vomited on one or two occasions. She complained of slight pain in both feet, and there was a bilateral mottled appearance of the skin on the plantar and dorsal areas extending up to the ankle. Ergot had been discontinued. The total amount taken during this time was two and a half ounces.

On June 22, the eighth day postpartum, pulsation in the radials, popliteals, and dorsalis pedis arteries was still absent. The right foot gave the impression of early gangrene.

A neurologic examination disclosed the following: cranial nerves normal. Upper deep reflexes lively and equal. Right knee jerk greater than left. Sensation normal

in upper extremities, body, and thighs. Areas of hyperalgesia beginning at about middle of each leg descending in stocking fashion to the ankles, with gradually diminishing perception of pin prick and ending in complete analgesia in both feet. Touch was similarly but less markedly affected. The pupils reacted to light and accommodation. Eyegrounds were normal.

On the morning of June 23, the ninth day postpartum, about forty hours from date at which the drug was discontinued and approximately sixty hours following the loss of pulsation in the radials, the hands felt warmer, and there was a return of pulsation in these vessels. The left foot was cyanotic and was suggestive of impending gangrene.

The urine showed a faint trace of albumin. A blood count taken on June 21, showed R.B.C. 3,000,000, W.B.C. 23,000, polynuclears 82 per cent, small lymphocytes 15 per cent, large lymphocytes 3 per cent, and hemoglobin 64 per cent. Another count taken three days later showed R.B.C. 3,700,000, W.B.C. 20,000, polynuclears 88 per cent, small lymphocytes 10 per cent, large lymphocytes 2 per cent, and hemoglobin 70 per cent. Wassermann test negative.

On June 24, the tenth day postpartum, popliteal pulsation returned. On the next day the right foot appeared entirely normal, and pulsation was felt in the right dorsalis pedis artery. In the middle aspect of the left foot, however, a patch of gangrene the size of a quarter was observed; and on the twelfth to thirteenth days postpartum there was evidence of superficial necrosis on the dorsal area of the great toe and small patches on the other toes.

On June 28, the fourteenth day postpartum, there was quite marked edema of the dorsal aspect, with mottling half-way up the foot. The entire plantar surface including the toes showed a healthy color to the skin, with the exception of an area the size of a silver dollar on the middle portion which appeared gangrenous. The foot appeared warm.

On the sixteenth day postpartum sensation returned in both the plantar and dorsal region of all the toes. One week later there was considerable sloughing of the skin on the middle portion of the dorsal aspect. Thereafter the edema on the dorsal area became considerably less, and on July 11, the twenty-seventh day postpartum, pulsation of the left dorsalis pedis finally returned. The slough from the dorsum and plantar surfaces was removed, and the nail of the big toe came away. The wound was treated accordingly, and the patient was discharged from the hospital on August 27, seventy-five days postpartum, with the entire wound practically healed and with ability to flex and extend the toes slightly.

She was requested to report for further observation, and when last seen in June, 1927, she presented the following: Slight atrophy of the foot, cold to touch. There was loss of the nail of the big toe and trophic disturbance of other nails which were rigid, white, and chalky. The pulses were good. There was no evidence of serious involvement of the circulation. The reflexes were normal. There was contraction of the interossei muscles, and flexion contraction of all the toes produced metatarsalgia, giving her slight pain in walking.

#### COMMENT

That the above case appears to be one of ergot poisoning seems beyond question. A careful study of the history and clinical course of the disease will dissipate all doubt that this patient presented uncommon features of ergot poisoning. Many patients may produce symptoms of intoxication, manifested by nausea and vomiting, particularly when the drug is employed by women in attempts at abortion, but, of the cases described, none showed the severe type embracing both the spasmodic and gangrenous forms herewith reported.



I believe that she evidently had an idiosyncrasy for the drug, because the amount consumed was not large. Even without the aid of any therapeutic agent used, it is interesting to note, that after the condition was suspected and the drug discontinued, relief of symptoms was obtained and the return of pulsation in many vessels occurred.

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ONE WEST ONE HUNDRED AND TWENTY-THIRD STREET.

## A NEW APPARATUS FOR RESUSCITATION OF ASPHYXIATED NEWBORN BABIES

BY JOSEPH KREISELMAN, M.D., HOWARD F. KANE, M.D., F.A.C.S., AND  
ROBERT B. SWOPE, E.E., WASHINGTON, D. C.

THE object of this apparatus is to fulfill one of the essential requisites in the treatment of asphyxia neonatorum, namely, to supply oxygen to the blood in an effective manner with the utmost assurance that even though the operator be inexperienced, there will be no danger to the patient. This is accomplished by delivering the oxygen in controlled amounts and at controlled pressures to the lungs without obstruction to the airway.

The apparatus herewith presented is simple, easy to operate, and has safety devices which make it impossible to deliver oxygen to the lungs at excessive pressures. It consists of a high pressure regulator, a low pressure regulator, a control valve, a pressure relieving and indicating device, and a one unit face-piece with breathing tube.

The high pressure regulator (*B*) has one gauge (*D*) to indicate the pressure of the cylinder contents, and another (*E*) to indicate the pressure against the second regulator (*F*). The low pressure regulator (*F*) is a large diaphragm unit giving the necessary low pressure. Although two pressure reducing devices are employed in order to safeguard the patient, it is desirable to have further assurance that the patient will not be injured by excessive pressure under any conditions. To this end a pressure relieving device (*Q*) is employed. This device not only relieves excessive pressure, but also gives constant indication of the pressure of the gas by means of a water column in a graduated glass tube (*S*).

A new type face-piece (*N*) is used. This is a bakelite shield adapted to fit over the mouth and nose. This face-piece is funnel-shaped and its smaller end is provided with an aperture for admitting the gas. The larger end of the shield is

covered on its edge by a soft rubber pad (*O*) for sealing the space between the face of the patient and the shield. A stiffly flexible rubber breathing tube (*K*) is attached to the shield at the point through which the gas enters, and extends over the tongue into the pharynx. This unit (face-piece and breathing tube) provides a clear, unobstructed passage for the gas from the machine to the lungs of the patient without change in the pressure of the gas. Simply placing the face-piece over the face with the breathing tube over the tongue provides this free passage. This is absolutely essential in the resuscitation of asphyxiated newborn babies. If this breathing tube were not used, the result sought would be largely defeated because the relaxed tongue would be pushed backwards, obstructing the air passage. In this event, if sufficient pressure were employed to force oxygen past this obstruction at all times, there would be danger of suddenly filling the lungs with gas under such pressure that they would be ruptured. With the improved face-piece, however, it is possible to use an entirely safe and nonfluctuating pressure.

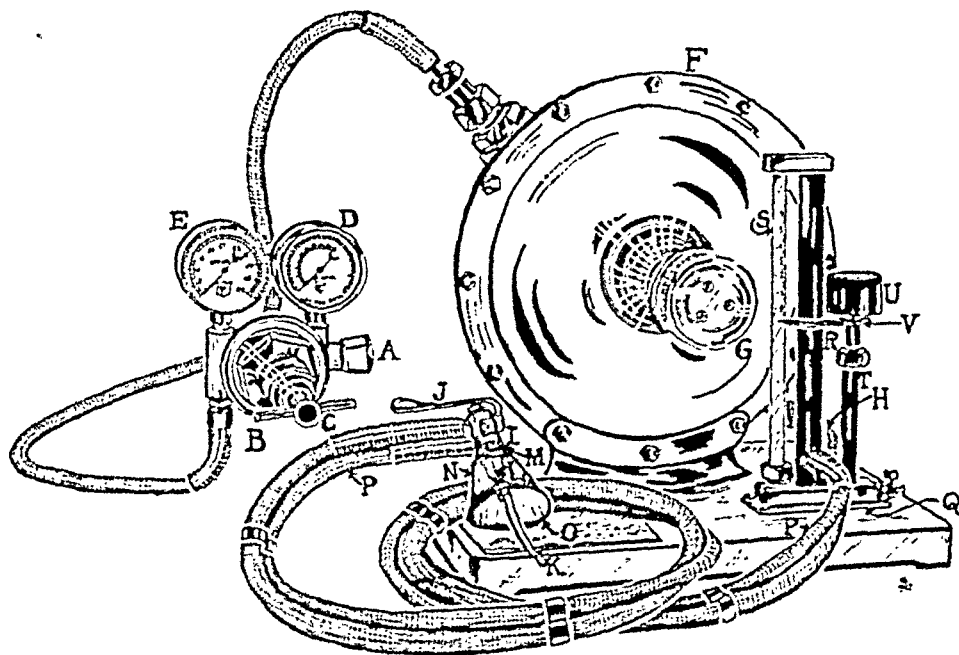


Fig. 1.—Resuscitation Apparatus. *A*, oxygen or carbon dioxide cylinder; *B*, high pressure regulator; *C*, high pressure regulator handle; *D*, high reading gauge; *E*, low reading gauge; *F*, low pressure regulator; *G*, low pressure regulator adjusting knob; *H*, oxygen tube from low pressure regulator to valve on face-piece; *I*, face-piece valve; *J*, valve handle; *K*, breathing tube; *L*, auxiliary oxygen inlet and expiratory outlet; *M*, expiratory outlets to atmosphere and atmosphere inlets; *N*, Bakelite face-piece; *O*, rubber piece; *P*, connection from face-piece valve to manometer; *Q*, combined safety valve and manometer; *R*, stand-pipe; *S*, graduated glass tube; *T*, adjustable overflow tube; *U*, overflow cup; *V*, pressure indicator.

By means of a slip-joint the face-piece with breathing tube attached is easily removable for sterilization by boiling.

The valve is so designed as to serve a double purpose. When the handle is depressed, oxygen is admitted to the mask, and when it is released the expired gas escapes into the atmosphere through openings which are provided. The valve (*I*), when operated, provides a passage for the flow of gas from the low pressure regulator through the breathing tube to the lungs, and, at the same time closes the expiratory outlet (*M*) and connects with the pressure relieving and indicating device (*Q*). When the valve handle is released, the gas inlet is closed and the expiratory outlet is opened, permitting the escape of gas from the deflated lung through *L* and *M*. Expiratory outlets *L* and *M* also provide for the entrance of air, should respiration occur while the valve is closed.

The pressure at which the gas is delivered is controlled by adjusting the knob (*G*) on the low pressure regulator (*F*). Opening the valve (*I*) allows the gas at this determined pressure to pass through tube *H* to the face-piece and thence to the lungs. This pressure is transmitted through tube *P* to manometer *Q* and is indicated by the rise of a column of water in glass tube *S*. This manometer, *S*, combined with stand-pipe, *R*, and adjustable overflow tube, *T*, comprises a safety device. These three tubes intercommunicate and are filled with water to the level of the zero mark on the manometer. Gas under pressure being conveyed to the top of stand-pipe, *R*, forces the fluid to rise equally in manometer and adjustable overflow tube. The indicator (*V*) attached to the base of the overflow cup (*U*) is adjusted to the upper point of the desired excursion of the water column. Should the required pressure be exceeded, the column of water in the adjustable overflow tube would be forced into the cup, allowing the relief of excess pressure.

Pressure of approximately six inches of water has been found by experiments to inflate the average lung satisfactorily. Should the pressure, however, be so great as to cause the manometer tube to overflow, the lungs would not be damaged.

#### OPERATION OF APPARATUS

1. Raise or lower the overflow cup of the manometer until the indicator points to the "6" mark on the manometer scale. Pour water into the cup until the level rises to the zero mark.

2. Open the cylinder valve.

3. Adjust the high-pressure regulator so that the low-reading gauge indicates 5 pounds pressure.

4. Close the face-piece and tube with the palm of the hand, press the valve-handle, and adjust the low-pressure regulator by turning the knob until the water rises to the desired level in the water column.

5. Raise or lower the overflow cup until the indicator points to the desired level mark on the manometer scale.

6. Place the face-piece in position over the mouth and nose with the breathing tube over the tongue into the pharynx.

7. Press the valve handle to inflate the lungs, and release to deflate. Four or five inflations per minute are ordinarily sufficient.

The cases here reported were taken at random from those treated in Sibley Hospital, Washington, D. C., and are cited merely to give an idea of the results.

CASE 1.—Cesarean section. Baby cyanotic. Pulse 60. For fifteen minutes artificial respiration and other methods of resuscitation were employed unsuccessfully. With first inflation by apparatus, color and pulse improved. Respiration established in five minutes.

CASE 2.—Normal delivery. Born 3:30 P.M. Heart slow. Oxygen first administered at 3:45 P.M. after unsuccessful attempts at resuscitation by other means. First respiration at 3:52 P.M.

CASE 3.—Normal delivery. Pallid. No respiratory efforts or discernible heart action. Inflation started about five minutes after birth. In one minute heart action was seen, and in ten minutes respiration was established.

CASE 4.—Normal delivery. Pallid. No heartbeat heard or felt. Usual methods of resuscitation used for fifteen minutes. First respiration seven minutes after oxygen was started.

CASE 5.—Manual rotation and midforceps after thirty-hour labor. Pallid, heart slow, faint and irregular. Oxygen started immediately. Heart action became strong and regular, color became pink, but no respiration for forty-five minutes. Infant showed symptoms of intracranial pressure, but fully recovered.

CASE 6.—Normal delivery. Cyanotic. Heart action weak and failing. Following ten minutes of trial by other methods, breathing began after three or four inflations with oxygen.

CASE 7.—Normal delivery. Rapid labor. Pallid. Heart action scarcely discernible. Oxygen started in five minutes. Color and pulse improved immediately, and after four or five inflations infant cried.

CASE 8.—Normal delivery. Cyanotic. Attempts at respiration were merely shallow gasps. Much thick tenaceous mucus. After a few inflations normal respiration was established.

CASE 9.—Low forceps. Large amount of mucus which could not be removed. Heart action fair at birth but gradually failed. Alternate inflations and attempts at removal of mucus by posture. First respiration twenty-one minutes after birth.

CASE 10.—High forceps. Pallid. No evidence of cardiac or respiratory action. Resuscitation attempted by all usual methods. After thirty minutes, efforts were discontinued. One hour and fifteen minutes after birth, oxygen was first administered. Within five minutes heart action was seen, and color became pink. First respiration thirty minutes after inflations were begun. This infant died fourteen hours later.

#### CONCLUSIONS

The apparatus has been in use about one year, and during this time many patients have been treated by various doctors, internes, and nurses, without previous experience. Both oxygen and carbon dioxide have been employed with no apparent difference in results. Further research is being carried on in an effort to determine the comparative value of these two agents.

The apparatus is simple to operate.

It is reliable, never once having been out of order.

It supplies oxygen promptly and effectively to the lungs of the patient.

The upper air passages are always kept clear by use of this new type face-piece.

Experiments on fresh cadavers have shown that the maximum pressure delivered by the apparatus is insufficient to rupture the air vesicles of the lungs.

1615 KENYON STREET, N. W.

# A PELVIMETER FOR THE DIRECT MEASUREMENT OF THE TRUE OBSTETRIC CONJUGATE

BY JOSEPH T. SMITH, JR., M.D., CLEVELAND, OHIO

(From the Clinic of Cleveland Maternity Hospital and Western Reserve University)

WITH the desire of developing an instrument which would measure the true conjugate directly, the device illustrated in the accompanying pictures is suggested for trial.

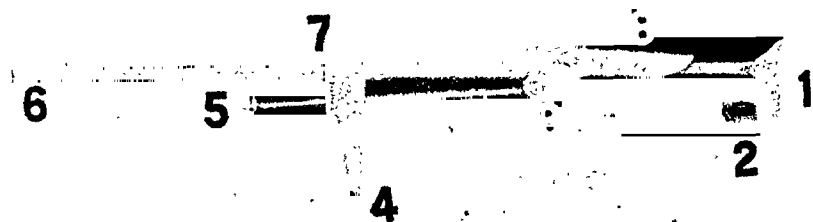


Fig. 1.—Pelvimeter folded for introduction.

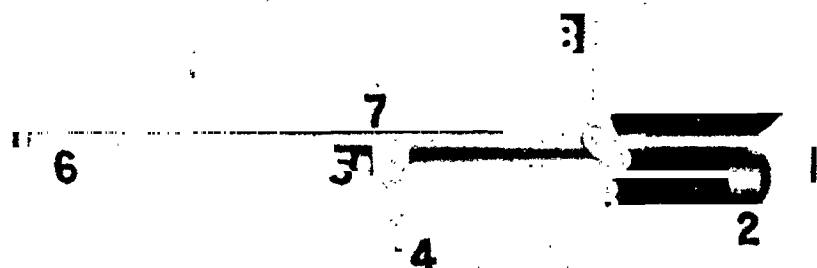


Fig. 2.—Pelvimeter arm raised for measurement.

This instrument consists of a small but rigid square steel bar, carrying a saddle-shaped piece (1) at one end. (Fig. 1.) At (2) is a thimble for the middle finger. On this bar, a sliding sleeve (3-7) is controlled by the handle (4). Back of this handle, a button (5) actuates a rod which raises an arm (8) at right angles to the bar (1-6) when the button is pushed in as far as it will go. Centimeter calibration marks on the upper side of the bar are read at the point 7, where the end of the sliding sleeve (3-7) cuts the bar.

The pelvimeter is made as slim as possible, and when the arm (8) is folded down, the whole device is about the diameter of a man's finger. Thus, it may be carried into the vagina without causing pain.

In use, the middle finger of the examining hand is slipped into the thimble at 2. The instrument, well lubricated, is carried into the vagina by the middle and index fingers. The examiner then locates the promontory of the sacrum with the middle finger, which may be slipped out of the thimble temporarily for this purpose. The procedure is exactly the same as that described in standard textbooks for the measurement of the diagonal conjugate. With the middle finger in the thimble (2), the saddle 1 is now rested over the sacral promontory. The other hand,

grasping the handle (4), slides the sleeve within the vagina, with the arm (8) folded down. The handle (4) does not enter the vagina. Pressure on the button (5) with the thumb raises the arm (8) to a right angle. Holding it firmly in this position, and with the bar firm against the under surface of the pubic arch, the handle (4) is drawn outward until the arm (8) is pressed firmly against the posterior surface of the os pubis. (Fig. 2.)

The instrument is then read directly at the last figure showing under the sleeve at the point (7). This calibration is not calculated straight along the bar (1-6).



Fig. 3. Introducing folded pelvimeter.



Fig. 4.—Arm raised, measuring.

The figures represent the distances from the point (1) in the curve of the saddle, i.e., from the point where that touches the sacral promontory, to the point 2.5 cm. up the arm (8), i.e., the point where numerous measurements teach us that the arm generally touches the most posterior point of the os pubis. In other words, the scale gives the length of the imaginary hypotenuse (8-1) of the triangle (1-5-8). That hypotenuse, when the instrument is in place, is the true obstetric conjugate, and its length may be read directly, on the scale at 7.

A slight pull on the button (5) now folds down the arm (8), and the instrument may be removed easily and painlessly.

I wish to thank Dr. Arthur H. Bill for his encouragement and for permission to test out the instrument on many patients in the clinic of the Cleveland Maternity Hospital. I also wish to acknowledge the interest and intelligent cooperation of Mr. George Guilford, who made the instrument, following a model.

2429 PROSPECT AVENUE.

## REPORT OF A CASE OF BICORNUATE UTERUS

BY E. C. STEINHARTER, M.D., AND SAMUEL BROWN, M.D.  
CINCINNATI, OHIO

FULL-TERM pregnancy in a bicornuate uterus is probably not so uncommon as the paucity of the literature on the subject and the experience of the busy obstetrician would lead one to believe. The reason for this is that the condition can occur without being recognized, since gestation, labor, and puerperium may all be uneventful. In rare cases, however, according to Williams,<sup>1</sup> the nonpregnant horn may partially fill up the pelvic cavity and give rise to a serious dystocia similar to that produced by tumors of other origin.

The following report is that of a patient who had a series of full-term normal confinements before it was discovered that she had a bicornuate septate uterus. In this particular case the positive diagnosis was made by x-ray, aided by lipiodol and later confirmed by exploration of the uterus from below and inspection of it intraabdominally.

I. F., aged thirty-three years, housewife. Her chief complaints were: skipping a period from time to time and pain in the lower abdomen. Past history was negative, except for general debility during past year.

First pregnancy was a miscarriage at three months, followed by three normal full-term pregnancies and then an incomplete abortion at four months, for which she was curetted. The gynecologist at this time apparently failed to observe a uterine septum. Catamenia at seventeen years. Dysmenorrhea the first day. Periods regular until recently, lasting five days with profuse flow. In the past year the menstruation has become irregular, the periods occurring at intervals of from 4 to 8 weeks.

For a few months prior to being referred to one of us (E. C. S.) for gynecologic examination, the patient had been under the care of an internist because of general debility, poor appetite, and pain in lower abdomen, especially on the right side. She stated that she had skipped a period due twenty days before, but did not consider herself pregnant. Bimanual examination revealed a slightly enlarged irregular uterus. In the right vault, low down, there was a tender sausage-shaped mass about the size of a nulliparous uterus, and it moved with the cervix and the uterus.

<sup>1</sup>Williams: *Textbook on Obstetrics*, New York, 1909, D. Appleton & Co., p. 110.

Radiographic examination at this time revealed a pregnancy in a bicornuate uterus. (Fig. 1.) It will be observed that the two horns did not undergo equal hypertrophy. As the general condition of the patient was poor, interruption of pregnancy was considered, but finally decided against when the patient began to show improvement in health. From time to time during gestation she was examined bimanually, but no enlargement of the nongravid horn could be made out. Two hundred and twenty days after the roentgenographic examination, the patient delivered herself by precipitous labor of a full-term normal baby girl weighing five pounds, four ounces. The obstetrician in charge reported nothing unusual about the pelvic organs. The puerperium was uneventful.

Four months after delivery another roentgenographic examination was made. The uterus at this time was also examined digitally and by uterine probe, and the septum was felt to be a definite continuous partition, extending from the



Fig. 1.—Radiogram of a two months' pregnant bicornuate uterus, showing gravid and nongravid horns.

fundus to just above the internal os and spreading out fanwise from below upward. Eight months after delivery the patient was operated upon (by E. C. S.) for appendicitis. The appendix was found to be subacutely inflamed. Advantage was taken of the laparotomy to inspect the uterus. It was found to be saddle-shaped at the fundus, and the area from the fundus to the cervix, uniting the two horns had the appearance of a raphé. It seems that such a uterus falls into the classification of uterus bicornis unicolis septus duplex.

*Comment.*—Although the introduction of iodized oil into the pregnant uterus in this case did not induce abortion and Heuser<sup>2</sup> reports a similar experience in a series of gestating cases in which interrup-

<sup>2</sup>Heuser: Bull. et mém. Soc. de radiol. méd. de Par., 1925, xiii, 126.



tion of pregnancy was indicated nevertheless we wish to emphasize that for the diagnosis of early normal pregnancy the roentgenographic method involving the injection of iodized oil into the uterine cavity should not be used, notwithstanding this apparent harmlessness to both the mother and the fetus. The method should be reserved for the diagnosis of early pregnancy in those patients suffering from conditions which would contraindicate the continuation of pregnancy if the latter existed. In the above case the unusual findings on pelvic examination, the seeming improbability of the existence of pregnancy, and the very poor general condition of the patient prompted us to employ the radiographic method for arriving at the diagnosis.

505 DOCTORS BUILDING.

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## A CASE OF LIVER PRESENTATION IN SEVEN AND A HALF MONTHS GESTATION

BY E. S. GURDJIAN, M.D., PH.D., ROCHESTER, N. Y.

*(From the Obstetric Service, Rochester General Hospital)*

IN THE differential diagnosis of placenta previa, especially of the marginal type, one should also consider a very rare condition; namely, the presentation at the external os of abdominal contents (especially the liver), in fetuses with a ventral hernial sac. Such a case was noted in Doctor Brown's Clinic, of the Rochester General Hospital.

Mrs. R. M. was treated at this hospital for syphilis and epilepsy previous to her pregnancy. After an intensive course of treatment her Wassermann reaction became negative. She was married December, 1926. At the prenatal clinic it was found that the pelvic measurements were normal. Her last menstrual period was December 16, 1926. She gave no history of previous pregnancies or miscarriages. On August 1, 1927, she complained of slight bleeding from the vagina. On August 3, at 6 A.M., she was seized with pains over the back and the abdomen, and at this time also passed some blood-tinged fluid. She came to the clinic on the same day, and it was found that the cervix was barely dilated to the extent of one finger. No typical contractions were observed. The fetal heart was not heard. The patient was advised to go to bed and rest. In the evening of the same day her pains became worse, and she was admitted to the ward and given  $\frac{1}{4}$  grain of morphine. At this time also the fetal heart was not heard. About 12 P.M. the cervix was found to be dilated three fingers' breadth. A boggy, spongy mass was felt at the external os, to the right of which a flexed small part was also noted. The vaginal examination was followed by bleeding. The question of a marginal placenta previa was kept in mind, and the patient was closely watched. At 3:55 A.M., August 4, the membranes ruptured, and at 4 A.M. the cervix was found to be fully dilated. The same spongy, boggy mass was presenting at the outlet, with a flexed knee to the right. The vaginal manipulation was again followed by bleeding. Because of the possibility of a placenta previa, it was thought advisable to extract the fetus as soon as possible. When the presenting part was extracted far enough to be seen, it was noted that it overlay a group



# Society Transactions

## CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF APRIL 15, 1927

DR. J. B. DeLEE reported a case of Pubiotomy.

Mrs. N., age twenty-nine, an instructor in athletics. Over term 5 days; in labor 33 hours; almost complete dilatation for 12 hours without progress. The head was engaged, occiput 1 cm. below interspinous line, position occiput left transverse; labor completely arrested for 12 hours. Attempts at forceps had been made by two operators without avail. Forceps again applied, 2 tractions failed; left in situ; pubiotomy selected in preference to low cervical cesarean because there was a question of the viability of the child; the heartbeat was regular though slow. Membranes ruptured 28 hours before. Numerous examinations and two operations had been attempted. Three Dührssen's incisions had been made in the cervix. It appeared that just a little more room in the pelvis would permit delivery. The head was fully engaged and rotated readily in the forceps.

The sawing of the bone was easy but no separation of the ends occurred and using all legitimate abduction of the thighs in extreme flexion it was possible to obtain only 12 mm. separation of the ends. Delivery by forceps was easily accomplished. The baby, weight 3300 grams, succumbed in a few hours. No autopsy permitted.

Repair of the perineum with silkworm gut figure of eight sutures. A small hematoma of left labium suppurated. Moderate degree of phlebitis began on the seventh day. Left hospital on thirtieth day. Examination after 2 months shows thickening of the periosteum over the left sacro-iliac joint and to some degree on right. Locomotion good. X-ray clearly showed a transversely contracted pelvis.

### DISCUSSION

DR. J. L. BAER said he had seen many pubiotomies in Vienna, where it was quite the vogue in 1907. There were literally dozens of women who had been operated upon at varying intervals previously. He saw every conceivable kind of trauma; huge hematomas of the labia, perivaginal infections, vesico-vaginal fistulae of enormous size. He saw women whose pelvis had been widely separated, many with a resulting waddling gait. There was rarely a bony, simply a fibrous, union. Trauma seemed to be in direct proportion to the time of extraction of the fetus after pubiotomy had been done, so it appeared that when pubiotomy is indicated, it is wise to let labor progress spontaneously to an outlet level, instead of doing an immediate forceps extraction. That was the added blow which produced many of the injuries, infections and tears following pubiotomy. His observation and experience with it, led him to place it in the category of rare operations.

DR. DeLEE, in closing, said the head was fully engaged. The bones did not part because there was synostosis of the sacro-iliaca.

Transversely contracted pelvis are not very rare, as he had found quite a few that were contracted in the narrow pelvic plane.

With reference to Dr. Davis' remark about the position of the head at the beginning of labor, he said he was called in when it was in the pelvis in the transverse diameter.

The second question as to whether athletic instructors always have trouble and why, he couldn't answer, although he believed that women who have been very active in athletics have narrow arched pelves with firm bones that do not soften up so much during labor. Their perineums are rather deep.

In answer to Dr. Holmes, he said he did not know how the baby was going to do. It was alive, not dying by any means, which brings up the very important question of a craniotomy on a live baby.

He agreed that too many pubiotomies and too many cesarean sections are done on poor risks. He was certain that were this case treated ten years ago, he would not think of doing a pubiotomy. Kuestner in Breslau has done 230 cesarean sections of the low extraperitoneal cervical variety. He operates whether the women have been examined or not, even with fever, so long as the baby is alive. He believes in doing cesarean section rather than sacrifice the baby's life.

Here was a case in which Dr. DeLee was sure the baby was not dead, and only a slight enlargement of the pelvis was needed. That was one of the reasons why he chose pubiotomy in preference to low cervical section, and the event proved the correctness of the assumption. The fact that Dührssen incisions had been made was a very prominent factor. The element of infection would not have deterred him from a low cervical because she was in the hospital and all the manipulations had been done in the hospital.

DR. W. C. DANFORTH read a paper on the **Immediate Repair of Cervical Injuries After Labor.** (See page 505.)

#### DISCUSSION

DR. C. S. BACON believed that Dr. Danforth was right in his contention that the cervix should be repaired when there is any tear of considerable extent and also right in warning against the general adoption of this procedure unless he is quite sure of the ability of the physician who is not an obstetrician to avoid infection. He emphasized the possibility of determining whether a tear is going to occur. Dr. Danforth found that about one-third of all the cases that were torn needed some repair. He thought it could be determined during labor which are the cases that are likely to be torn. There is an indication as to whether the cervix is liable to be torn in what takes place at the end of the first stage of labor. If there is no bleeding there is probably no tear. If there is considerable bleeding which persists during several contractions and sometimes continues for an hour or more, almost surely there will be a tear because one is dealing with a hard cervix, not fully dilated. These are the cases which should be examined. If there has been absolutely no "second show," no sign of bleeding, there probably has been no tear and it is not necessary to expose the cervix and run the risk of an infection at this time.

The introduction of the first suture in the case of a rather deep tear may be better done by tying it from the inside of the cervix rather than from the outside. Better apposition is secured in that way.

DR. J. B. DELEE agreed with Dr. Danforth as to the importance of sewing up cervical lacerations. He also felt the way Dr. Bacon did about the apical suture of the cervix as a routine in all cases. The majority of cases that come in are already torn. The practitioner must be educated to do good obstetric surgery, which is a slow process.

He called attention to Dr. Titian Coffey's method. The eighth or ninth day after delivery, under morphine or gas he makes a regular Emmett repair of the cervix. He has done it for eight or ten years and reports that the women come

back with good cervices. Once in a while they have a lochiametra but he gets them up and it disappears. He believes it prevents permanent damage to the cervix and pelvic connective tissues.

The French believe in the prophylactic cervical incisions. They say nature does not know how to make a dilatation of the cervix. Therefore as soon as the effacement is complete, the cervix is cut.

The frequency of cervical tears is much greater in his experience than Dr. Danforth finds it. He has seen deep cervical tears after very easy deliveries. It occurred to him that the Gwathmey method of anesthesia predisposes to cervical tears. Quinine in the rectal anesthetic, 20 grains, sometimes produces tempestuous uterine contractions, yet the woman suffers very little pain, while the cervix suffers laceration.

DR. CARL H. DAVIS believed that patients who have premature rupture of the membranes and then go on to complete delivery without the use of the bag are going to have more injury to the cervix than where the bag has been used. It would have been interesting if Dr. Danforth had reported in connection with these thirty-two cases how many heads were transverse and how many were occipitoposteriors. It is the experience of all obstetricians that where the head is in the transverse position there is a prolongation of the time before the cervix passes over the head.

He agreed with Dr. DeLee that there is some question regarding bringing the patient back to the operating room during the early puerperium. He would much rather send her back to the hospital some weeks later, after involution is complete and perform a trachelorrhaphy. Perhaps a great many of the small tears may be taken care of immediately and reduce the necessity for later trachelorrhaphy.

DR. C. B. REED abandoned the operation where the cervix was definitely swollen. In this case no allowance was made for the swelling and the stitches would get loose. On the other hand, where he made the stitches so tight as to allow for subsequent shrinkage, they would cut through. Sometimes, he made the repair on one side and let the other side alone. Many of these cases healed spontaneously. Others would be torn at the next delivery and it seemed probable that the attempt to repair the injury that was done was a waste of time. He could not say that enough was gained in the suturing operation to justify taking chances that lengthened the work. In fact, he believed that the opinion prevailing among obstetricians that the cervical repair should await the end of the child-bearing period, is well founded.

DR. IRVING F. STEIN endorsed what Dr. Danforth said concerning the routine examination of the cervix after labor, and repair when the tear is of any magnitude. He maintained that a 2 cm. tear is sufficient to repair, but of course that was a matter of personal experience.

He did not know why Dr. Reed had the bad results reported. He uses the interrupted sutures referred to by Dr. Danforth tight enough for good approximation, but not tight enough for pressure necrosis. One of the requisites of cervical care after labor is first of all to examine in such a way that there is no undue pressure on the friable vaginal tissues. He found the McCormick retractors with the round ends and made of very springy steel, satisfactory for this purpose.

DR. JOSEPH L. BAER emphasized the effect involution has on the tear. When he demonstrates a cervix to the house staff, he points out that most of the tears that occur in spontaneous or moderately severe operative deliveries are tears that involve about one-fourth of the length of the full term cervix, measuring from the external os to the top of the lateral fornix. The final depth of the tear is then measured in terms of the involuted cervix, that is, one-fourth of its length or

less. Eversion accompanying ordinary small nicks as Dr. Davis pointed out, can be taken care of with the office caутery.

In the cervix all the thickness and edema are anteroposterior and all the thinning out is in the sides. The extreme lateral angles are very thin and the attempt to approximate them with a stitch is practically futile. That shows the retracted musculature to lie between the endocervix and mucosa of the vagina so when the musculature is brought out there is again a substantial thickness. Unless the tear is a real tear the approximation might just as well be left to scar formation because the depth of that tear is never more than a nick of the cervix. Promiscuous repair can well do more harm than good.

DR. J. P. GREENHILL said he had had occasion to look over a fairly large series of sections of the cervix uteri of newborn infants. He found that on the sides of the cervix there was a definite decrease in the amount of muscular tissue. This may account for the fact that in many cervixes, there is much more thinning at the sides than there is in the anterior or posterior lip.

DR. G. F. HIBBERT said the question of cervical repair at the time of delivery recalled many cases that have come under his observation at the Central Free Dispensary. A large percentage of these were foreigners who had been delivered by midwives, and consequently had received no surgical attention at the time of their delivery. Perhaps their chief complaint was vaginal discharge, but very often sterility brings them to consult the doctor. In examining these women, a cervix is often found lacerated in several directions, oftentimes the tears extending far out in the lateral fornix. He often wondered whether these bad tears were not frequently a big factor producing sterility, but certainly the infections of the cervix could be minimized had these cases been repaired at the time of delivery. For this reason he agreed with Dr. Danforth regarding this subject.

DR. DANFORTH, in closing, said that many times one finds tears when no hemorrhage occurs. In his opinion the tear has to be rather deep in order to produce much hemorrhage. A tear two or three centimeters deep can be present without any serious bleeding.

He agreed with Dr. DeLee that tears can occur in normal labors. One woman mentioned in the paper had a tear on one side three centimeters in depth, without damage to the perineum.

He omitted from his figures the cases of manual dilatation because he wanted to show that tears occur when there is no traumatism.

He considered the point brought out by Dr. Stein as to gentleness in manipulation very important. In most of these cases, particularly the primiparae, one is dealing with an episiotomy which should be damaged as little as possible.

Some do not repair the cervix because they feel it may tear again. No surgeon ever made anything better than nature did in the first place. One does not use a similar argument to prove that an episiotomy should not be done on a primipara. That many times has to be incised again. The cervix should be in a healthy condition between labors even if sutures have to be used.

## MEETING OF MAY 20, 1927

**DR. SNYDER reported A Case of Pregnancy With Arterial Hypertension and Albuminuria, Premature Breech Delivery, Postpartum Laparotomy, Cholelithiasis, Pancreatitis and Glycosuria.**

The patient, twenty-two years old, para ii, was supposed to be at term March 3, 1927. She had had an uneventful delivery in her first pregnancy and came in early in her second pregnancy with a blood pressure of about 144. In December the pressure went up to 160/100. There was a trace of albumen. The patient was put to bed. There was a gradual increase in the blood pressure and an increase in the amount of albumen, and she was finally sent to the hospital on January 8 with a pressure of 180/112 and albumen 1.6 grams per liter. Within a few days the pressure was reduced to 130. On the 17th the albumen suddenly increased to 3.7 grams per liter with no change in the pressure. The output of urine was reduced to 300 c.c. daily with an intake of 1000 c.c. At this time the patient developed some epigastric pain which was thought to be a symptom of the toxemia. She had a breech presentation; went into labor and delivered spontaneously the night of the 17th. On the 18th she continued complaining of the epigastric pain but pulse and temperature were normal. The baby weighed two pounds and five ounces and lived about sixty hours.

This epigastric pain gradually increased over the gall bladder with distinct tenderness at this point. On the 19th the pulse and temperature gradually increased until about the middle of the evening the temperature was 102° and pulse 130. White cell count was 18,000. The same night the abdomen was opened and a straw-colored fluid found. On examining the appendix there was no very definite pathology. All the mucous membrane was slightly reddened. On the mesoappendix there appeared to be a small spot which was thought to be an area of fat necrosis. The appendix was removed. The mesentery and omentum were investigated and found covered with spots of fat necrosis. The pancreas was palpated and found to be thickened, enlarged and indurated. The gall bladder on palpation was found filled with stones. A drain was inserted down to the region of the appendix and another one to the head of the pancreas.

Ten or fifteen minutes after return from the operating room she was awake and the pulse had dropped to 108. Temperature gradually came down and she made an uneventful recovery. She was advised to have the gall bladder removed, and this was done on February 8. From this operation she likewise made an uneventful recovery.

The report on the catheterized specimen of urine received after operation showed a considerable amount of sugar. Had this report been received before operation it might have given the operator some idea of what to expect.

**DR. W. B. SERRIN**, by invitation, read a paper entitled, **A Report on 320 Postmortem Examinations on Feti at the Chicago Lying-In Hospital.** (This article will be published in the next issue of this Journal.)

**DR. EDWARD ALLEN**, by invitation, presented an **Analysis of Thirty-two Cases of Ectopic Pregnancy.** (For original article see page 540.)

## DISCUSSION

**DR. E. L. CORNELL** said that a posterior colpotomy was very good in a case in which a typical history or typical findings of ectopic pregnancy may be absent. Where there is a history of a missed period and irregular vaginal bleeding,

it seemed to him that it was not quite necessary to puncture or open the posterior culdesac since the needle is a very easy method of determining whether blood is present. He had tried it several times and was able to enter the posterior culdesac and withdraw the blood in cases of ectopic pregnancy. In one case with an atypical, subacute appendicitis he was able to obtain some fluid pus from the posterior culdesac, which of course ruled out the question of ectopic pregnancy but also determined him to open the abdomen and remove the appendix. In cases of ruptured corpus luteum cysts, which are not infrequent, this same method can be employed. The fluid withdrawn will be straw colored, in which event operation can be postponed until the symptoms and condition of the patient permit. He said it was interesting to hear that the removal of an ectopic pregnancy by the vaginal route is being advocated again.

DR. CAREY CULBERTSON said the report of Dr. Allen was very important, though based on a relatively small number of cases, because of the fact that posterior colpotomy is advocated. Removal by the vaginal route is not new because it developed in the early days of gynecologic surgery when almost everything was attempted from below. By 1898 Kelly had operated a considerable number of ectopic pregnancies by the vaginal route. Many surgeons today would favor this route but are afraid of approaching the pelvis from below. One reason for this is the fear of bleeding, since hemorrhages have followed posterior colpotomy. It is true that when the incision is made close to the external os there is more hemorrhage from the wound than if the incision were made a little higher up where the vaginal vault is free, in the rectovaginal septum. Naturally the incision must not be carried too far laterally into the broad ligaments. He has used this method a great deal and advocates it not only for diagnostic but for therapeutic purposes. Given a mass in the pelvis, the nature of which is uncertain, there is no objection to making an incision that will show what is there. A needle, of course, may be almost equally effective. If the blood is fluid it will run out; if it is clotted it will not. If it is pus, the abscess can be evacuated much better by incision; here the trocar is apt to be only diagnostic. If the transverse wound is not sufficient in size it is very easy to enlarge it by a median incision posteriorly which will give a great deal better access. Danger to the rectum is practically nil, provided the incision is not followed by drainage with the old-fashioned rubber tube. In hematocele drainage need not be maintained.

Another reason why men are afraid to employ this method is because they have not trained themselves to work in this constricted canal. Naturally if there is an extensive mass involving the whole pelvis, that will be a case for abdominal section. It must not be forgotten that occasionally one of these cases will prove to be such as not to come in Dr. Allen's series. He had seen six cases of ectopic pregnancy associated with infection and abscess. Where the pregnancy is an early one and where the tube is not markedly enlarged it is not difficult to remove it from below.

Dr. Allen brought out the importance of thorough exploration in his cases. Several times in operating on ectopic pregnancy Dr. Culbertson had removed tubes that were just as normal as tubes could be. Twice in one winter he came upon pelvic hematoceles with normal tubes and where the only evidence of fetal implantation was in the fimbriated ends. The tubes were normally patent. Tubes of that sort should not be extirpated. One old teaching was that both tubes should be removed in a case of ectopic pregnancy. This is no longer followed. He operated on a woman during the winter by the vaginal route for a left tubal pregnancy. She had been operated upon by the abdominal route in February, 1926, for a right tubal pregnancy.

In Dr. Allen's series there were only two or three emergencies, which bore out Dr. Culbertson's experience in ectopic pregnancy. That is why the diagnosis



clinically is often missed by the average doctor. He is looking for shock, collapse, and threatened death before he makes the diagnosis. In some of the recent statistics as high as forty per cent of the cases did not have amenorrhea. Very few of these cases are emergencies. The patient can be taken to the hospital and watched until properly prepared for operation at the regular operating period.

DR. C. S. BACON said in Dr. Allen's paper the question comes up as to how one can distinguish between hemorrhages from different causes and how to make the diagnosis. In the great majority of cases operation is necessary, though a certain number of cases of ectopic pregnancy take care of themselves. It is not demonstrated that every case of pelvic hemorrhage should be operated on; the important thing is to make the diagnosis. If the patient is in the hospital under control it is safe to delay operation in doubtful cases where the findings are not at all conclusive. He did not believe in puncturing. The question is if there is hemorrhage is it coming from an ectopic pregnancy and is it necessary to operate?

DR. CAREY CULBERTSON was asked to close the discussion as Dr. Allen had been called away.

The point of an unruptured ectopic having been brought up, he emphasized again that a colpotomy incision would make the diagnosis where a needle would not because there would be nothing to run out through the needle. Those are the cases that are most easily handled by posterior colpotomy. He had one during the winter, an unruptured tube, not larger than two and one-half or three centimeters in diameter, perfectly free, with no adhesions.

Dr. Bacon's suggestion about conservative treatment was excellent. Some of these patients get along just as well without operation as with it. Many of them are treated for pelvic peritonitis and pus tubes. There is a swelling bilaterally and they are not very sick and do not show much reaction. They are treated conservatively and get along very well. At the County Hospital it is the rule that cases of ectopic pregnancy go to the obstetric ward; as a matter of fact the larger number are sent to the gynecologic ward with a diagnosis of pelvic peritonitis or salpingitis. He teaches his students that with the presence of a mass in the pelvis, ectopic pregnancy should be thought of. If with the mass there is metrorrhagia, pregnancy is three times as probable. If in addition, there is pain, the diagnosis is almost certain. If, with all this there is a history of preceding amenorrhea, the diagnosis is made. He said that he had had two cases which taught him the value of posterior colpotomy. One patient had metrorrhagia and he did an exploration of the uterus to see why she was bleeding. There was no palpable mass. She was put back to bed and the next day she had pain. The pain continued and examination revealed a mass in the pelvis. He did a posterior colpotomy and found an extrauterine pregnancy. In the second patient he did a diagnostic curettage and removed a large amount of material from the uterus which looked like hyperplasia of the endometrium. He left that evening on his vacation. The patient went home at the end of a week. The day following discharge from the hospital she had severe pain and her husband called in the nearest doctor who operated by the abdominal route and found an ectopic pregnancy. Upon return from the vacation sections of the scrapings showed normal decidua. In this case posterior colpotomy would have been better than the diagnostic curettage.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Collective Review

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### THE OBSTETRIC LITERATURE OF 1927

By J. P. GREENHILL, B.S., M.D., F.A.C.S.

*(Attending Obstetrician, Chicago Lying-in Hospital; Attending Gynecologist, Cook County Hospital; Associate in Obstetrics, Northwestern University Medical School)*

IN THIS year's review the attempt is made to analyze only a limited number of papers published during 1927 and to point out the essential ideas or facts presented in them.

#### PREGNANCY

*Physiology.*—The investigations of Krüger-Franke, Haagen and Ockel<sup>1</sup> reveal that during normal pregnancy the blood picture is similar to that of a mild infection, and during labor resembles that of a severe acute infection. Knaus<sup>2</sup> found that repeated injections of pituitary extract into pregnant rabbits early in pregnancy uniformly failed to disturb pregnancy, but injections given late in pregnancy invariably resulted in delivery. (These results may be paralleled in human beings; but if abnormal uterine contractions are present in the early months as in inevitable or incomplete abortions, pituitary preparations have a definite, stimulating action.)

According to Urner,<sup>3</sup> pregnant women may be vaccinated at any time during pregnancy without fear of obstetric complications. Lieberman<sup>4</sup> comes to the same conclusion but emphasizes that vaccination of the mother during pregnancy, resulting in a positive reaction, does not convey any specific immunity to the unborn infant. Slemons and Fagan<sup>5</sup> found a definite relationship between the mother's gain in weight during pregnancy and the baby's weight. In general the more the mother gained, the greater the weight of the baby at birth. Since Biehle<sup>6</sup> found a decrease in weight during the last few days of pregnancy in only 63 per cent of his cases, he cannot support Zange-meister's contention that a loss of weight toward the end of pregnancy indicates the early advent of labor. N. F. Miller<sup>7</sup> searched the literature for cases of pregnancy which followed inversion of the uterus, and analyzed 56 such cases. Among 25 manual corrections there were recurrences in subsequent pregnancies in 44 per cent, whereas among 22 cures by operation not one recurrence was noted. Among 29 confinements in the group corrected by operation there was not a single rupture of the uterus. While the results in cases corrected by operation are much superior in so far as future pregnancies are concerned, manual reduction should always be attempted first.

Miländer<sup>8</sup> added two more cases of pregnancy following inversion of the uterus.

Thoms<sup>9</sup> emphasizes the value of lateral roentgenograms of the pelvis to outline the vertical profile of the sacrum and the relationship that its promontory bears to the symphysis pubis. He<sup>10</sup> also discusses a simplified technic of x-ray pelvimetry. (Because of the ease and relative safety with which cesarean sections can be performed, pelvic measurements often are not as systematically nor as carefully taken as they should be. It is bad practice to permit a patient to go into labor without knowing everything about her pelvic bones and if the x-ray is necessary to complete the information, it should be used without any hesitation.)

*Abortion.*—Cultures were obtained by Nickel and Mussey<sup>11</sup> from the tonsils of one patient and from the teeth of three other patients who had had abortions. In three cases injection of these cultures into guinea pigs produced abortions. The causative organism was a green-producing streptococcus. Reith<sup>12</sup> injected green-producing anaerobic streptococci obtained from the tonsils and placenta of a woman who had had repeated spontaneous abortions into four pregnant rabbits and produced abortions in all of them. Vignes<sup>13</sup> reports a case of habitual abortion in which there was acute decidual infection during two of four abortions. In the fifth pregnancy streptococci were found in the gums of the mouth and in the vaginal discharge. An auto-vaccine was given to the patient and she went to term and delivered a living child. (These experiments of Nickel and Mussey, and of Reith support the contention made by DeLee more than twenty years ago that an infection may cause abortions.)

From an experience with nine cases, Fürst<sup>14</sup> comes to the conclusion that interruption of pregnancy by means of the x-ray is not a good procedure because in many cases the ovum is not completely expelled even after a long time, hence hemorrhage and infection may set in. On the other hand, Wyser and Mayer<sup>15</sup> found this method of producing therapeutic abortion a very satisfactory one.

Several authors have recently expressed the opinion that where a pregnant uterus is inadvertently radiated, the pregnancy should be interrupted because of the probable harm to the fetus. Sachs<sup>16</sup> takes issue with this statement because he can show that in many instances perfectly normal babies were born after x-ray treatment was applied during pregnancy. Mundell<sup>17</sup> discusses this same question as well as that of cancer of the cervix complicating pregnancy.

For the treatment of septic abortion Kessler<sup>18</sup> advocates the use of quinine. Klein<sup>19</sup> studied in a large Russian clinic the effect of artificial abortions on subsequent labors and found that such abortions were followed in later pregnancies by more cases of adherent placenta, delay in the third stage, forceps delivery, abnormal presentation, placenta previa, eclampsia and postpartum hemorrhage. Atzerodt<sup>20</sup> studied the cases in the Giessen clinic but failed to find that abortions influenced subsequent labors. (The reviewer is inclined to believe with Klein that artificial abortion tends to cause disturbances in subsequent pregnancies and labors.)

Deaths due to hemorrhage from abortion were reported by Qing,<sup>21</sup> Bass,<sup>22</sup> Mandelbaum,<sup>23</sup> and Federlin.<sup>24</sup>

*Complications.*—Zinsstag<sup>25</sup> mentions that in the Aarau and Basle clinics all the fatal cases of heart disease during pregnancy were in

women who had mitral stenosis and he believes that pregnancy should be interrupted in cases of mitral stenosis regardless of whether or not signs of decompensation are present. v. Jaschke,<sup>26</sup> however, is of the opinion that interruption of pregnancy and sterilization are not justified in cases of mitral stenosis where there is complete compensation. These procedures should be resorted to only in cases of curable decompensation and lumbar anesthesia is to be used. Jensen<sup>27</sup> believes that in cases of mitral stenosis, the power of accommodation of the myocardium and not the narrowness of the stenosis, determines whether the patient can endure pregnancy and labor. In a series of 160 consecutive postmortem examinations on women who had died during pregnancy or the puerperium, Cruickshank<sup>28</sup> found eleven cases of acute endocarditis. These cases demonstrate the importance of sepsis in the causation of acute endocarditis in pregnant and recently delivered women. Hamilton and Kellogg<sup>29</sup> studied 215 patients with true cardiac disease. They believe ether is the anesthetic of choice and that the majority of cardiac patients are safest delivered with forceps. Corwin, Herriek, Valentine and Wilson<sup>30</sup> also advise the elimination of the second stage of labor by means of a forceps delivery under ether anesthesia. The results of their study indicate that pregnancy and labor when properly supervised are not a great menace to the safety or life of the average ambulant case of heart disease. (The wise obstetrician will always consult a heart specialist for the patients who have outspoken evidences of heart disease, because in patients who are not carefully watched, decompensation may set in suddenly, especially immediately after delivery. Local, infiltration anesthesia, aided by morphin or pantopon, should be used as much as possible, especially in the performance of cesarean section, episiotomy or forceps delivery.)

Hyman and Kessel<sup>31</sup> believe that all pregnant women should receive iodides throughout pregnancy as a prophylactic. (This may do harm.) Williamson<sup>32</sup> is of the opinion that no patient who has had a thyroidectomy should become pregnant for at least two years after the operation, even though her symptoms are alleviated.

It is the belief of Corbus and Danforth<sup>33</sup> that, since patients who have pyelitis during pregnancy show definite changes in the urinary tract after delivery, in some cases at least, this pathology must have been present before the pregnancy began. The acute attack of urinary infection during the pregnancy then would be due to aggravation of the original lesion by the pregnancy, or possibly to some additional obstruction by the pregnant uterus. (The specific gravity of the uterus is the same as that of the intestines, hence the uterus rarely compresses the ureters.) Sano<sup>34</sup> found that the sensitivity of the ureter to drugs is lessened during pregnancy and that disturbed innervation of the ureter has a close connection with pyelitis gravidarum.

In most cases pulmonary tuberculosis is made worse by the advent of pregnancy. This is evident usually in the first trimester and in the puerperium but not in the second half of pregnancy. Gross<sup>35</sup> believes that gestation should be interrupted only in the few cases where in the first three months there is no improvement under treatment.

Greenhill<sup>36</sup> discusses the question of operation during pregnancy and emphasizes that operations on gravid women especially in the early months, should be performed at a time which would correspond

with an intermenstrual period were the patient not pregnant; otherwise, abortion may result. In performing a laparotomy during pregnancy, the uterus should be handled as little and as gently as possible. After operation morphine should be given for a few days. According to Litzenberg,<sup>37</sup> ovarian cysts discovered during gestation, labor, or the puerperium with very few exceptions call for surgical interference at once.

Baumm<sup>38</sup> feels that the retroplacental blood is especially adapted for the Wassermann test, and is more sensitive than the blood from the arm veins, but Franken and Rothmann<sup>39</sup> believe that the Wassermann reaction of the maternal milk is just as reliable as that of the retroplacental blood.

Müller<sup>40</sup> found that the best results in the treatment of syphilitic pregnant women are obtained with a combination of salvarsan and bismuth. McCord<sup>41</sup> observed that 50 per cent of untreated luetic mothers had full-term, live babies whereas 75 per cent of the treated mothers had such babies. Contrary to the results of Moore and of Solomon, Belote<sup>42</sup> concludes that pregnancy does not seem to be a factor in the prevention of neurosyphilitic accidents.

Severe anemia in pregnancy is not uncommon in India as evidenced by the papers of McSwiney<sup>43</sup> and Balfour.<sup>44</sup> The former author believes that many cases are due to concealed syphilis while Balfour considers the anemia to be a toxemia due to the products of conception.

*The Toxemias.*—It is the opinion of Dieckmann and Crossen<sup>45</sup> that vomiting of pregnancy is due to a deranged metabolism particularly of the carbohydrates and for the treatment of the condition they give large amounts of glucose intravenously. Waters<sup>46</sup> obtained good results by giving glucose combined with insulin. Sachs<sup>47</sup> likewise had good results with insulin but he does not administer glucose at the same time because he believes the best results are seen when the patients have a mild hypoglycemia. (We must not forget that in the treatment of hyperemesis fluids are very essential. The value of insulin is debatable but one thing is certain, insulin should be used with great caution.)

Titus and Dodds<sup>48</sup> give excellent advice concerning the correct preparation of glucose solutions for intravenous use, and they point out the common causes and means of prevention of unfavorable reactions which occasionally follow the intravenous injection of glucose.

Johnston and Johnson<sup>49</sup> believe that the amines, especially tyramine, may be responsible for eclampsia, while Warden<sup>50</sup> advances the theory that the cause is a sudden accidental introduction of a considerable amount of amniotic fluid into the maternal blood stream. Young<sup>51</sup> believes that the eclamptic and recurring toxemias have a similar origin in a diseased placenta and that in both types the kidney lesion is secondary. Titus, Dodds and Willetts<sup>52</sup> have proved that the convulsions in eclampsia occur at a time when there is a "relative hypoglycemia" and are caused by sudden drops in blood sugar. Hence the use of insulin either with or without glucose in the treatment of this disease is unnecessary and contraindicated. Bokelmann<sup>53</sup> agrees with this opinion. Intravenous injection of hypertonic glucose solution as originally recommended by Titus now has a definite basis for its proved therapeutic value.

Siegel<sup>54</sup> contends that bromsulphalein is a valuable liver-function test and can be used to differentiate the various types of toxemia but

Cruikshank, Hewitt and Couper,<sup>55</sup> who studied many tests of hepatic function found that not one of them was of service for diagnosis or prognosis.

In a follow-up study, Corwin and Herrick<sup>56</sup> found that hypertension persisted for months or years in one-third of the cases of eclampsia, one-half of the cases of nephritic toxemias, and two-fifths of the cases of hypertensive toxemia. It is probable that pregnancy reveals rather than causes the disease. Nevermann<sup>57</sup> found that almost half the patients with eclampsia recover completely, but that in the other half some residue of the eclampsia remains especially in the form of headaches and memory disturbances.

Stander<sup>58</sup> has long maintained that there is a hyperglycemia in the toxemias. (Titus<sup>62</sup> and also Levy<sup>59</sup> found a hypoglycemia.) He noted that all inhalation anesthetics produced changes in the blood chemistry and in the liver which were very similar to those found in eclampsia. Hence he advocates the use of local or spinal anesthesia in cases of toxemia. Astley<sup>60</sup> also favors spinal anesthesia when performing cesarean section in toxemia cases. (Cesarean section under local, infiltration anesthesia is as easy as and certainly less dangerous than spinal anesthesia.) Stander also believes that insulin with a protective dose of glucose is helpful in cases of acidosis. Bland and Bernstein<sup>61</sup> urge the use of a salt-free diet in the treatment of pre-eclamptic toxemia. H. A. Miller and Martinez<sup>62</sup> strongly recommend the use of liver extract, Hoehenbichler<sup>63</sup> is enthusiastic about the quartz lamp and Wilson<sup>64</sup> praises intravenous injections of sodium bicarbonate for toxemic patients. Lazard<sup>65</sup> again advocates the use of magnesium sulphate. (The reviewer is convinced that magnesium sulphate is a very helpful drug in the toxemias of pregnancy). Waldstein<sup>66</sup> reports a series of 117 eclamptic patients in which the maternal mortality was 1.7 per cent and the fetal mortality 10.1 per cent. He believes that at term or early in labor the treatment of choice is cesarean section. Llamas-Massini<sup>67</sup> also favors surgical treatment in eclampsia and Stoeckel<sup>68</sup> claims that eclampsia should be treated in the same manner as a ruptured ectopic pregnancy, namely, by termination of the pregnancy. Freund<sup>69</sup> from a study of 321 cases of eclampsia likewise emphasizes that immediate delivery yields the best results. Williams,<sup>70</sup> however, agrees with Eden that after accouchement forcé, cesarean section is the least appropriate treatment of eclampsia. Since 1922 Williams has treated all his cases of eclampsia absolutely conservatively and his results have improved considerably. Rice<sup>71</sup> likewise found a decided reduction in mortality since the change to conservatism. (It is rather bewildering to find that one group of authorities claims better results with radical treatment and another group claims the reverse. Evidently the results in eclampsia depend upon more factors than the mere emptying or not emptying of the uterus. There is no doubt that in the past [and even now] a great deal of harm was done by accouchement forcé, and too much medication, venesection, gastric lavage, colonic irrigations, sweating and purgation. The general practitioner, especially in the home, will do best to trust nature for at least 90 per cent of the treatment. However, an obstetric specialist in a clean hospital will find that cesarean section gives the best results in a definite proportion of his cases, especially in primiparas who have large, viable babies, who are not

in labor, and who are having repeated convulsions. Local anesthesia should be used in nearly all cases of eclampsia where an anesthetic is necessary.)

#### LABOR

*General.*—Mayes<sup>72</sup> is of the opinion that the use of mercurochrome in obstetrics constitutes a valuable means of reducing the puerperal morbidity. (The reviewer agrees with Mayes. At the Chicago Lying-In Hospital gauze soaked in mercurochrome was packed into the uterus or lower uterine segment ten times and in eight instances no growth could be obtained from the gauze on culture media.) Ostreil<sup>73</sup> advocates the use of strychnine with other drugs for inducing labor at term. Mathieu<sup>74</sup> induced labor with castor oil, quinine and pituitary extract successfully in 96.7 per cent of 91 cases. Hofbauer, Hoerner and Oliver<sup>75</sup> introduce the intranasal application of pituitary extract for starting labor and claim excellent results. The possibility of withdrawing the drug as soon as the uterus passes into tetanic contraction makes the nasal application of pituitary preparations the safest method. (Nevertheless, even the safest method is not without danger. The patient must be closely watched and a can of ether should be near at hand. Even if the pledget is withdrawn quickly after the uterus becomes tetanic and the baby is born alive, some damage may perhaps have been done to the child's brain and symptoms may arise months later.)

Bourne and Burn<sup>76</sup> believe that small doses of pituitrin may be given with safety at any stage, provided there is no mechanical obstruction. (The graphic tracings of these authors are similar to those of Haskell and Rucker<sup>77</sup> whose conclusions were the reverse. In many tracings there was a prolonged tonic contraction with superimposed waves of contraction. These tracings undoubtedly indicate interference with placental circulation and hence danger to the child.)

An excellent discussion on the clinical signs of fetal distress during labor and the treatment is presented by Freed.<sup>78</sup> (It cannot be reiterated too frequently that the fetal heart tones should be carefully and constantly controlled throughout labor in the first stage as well as the second.)

*Analgesia and Anesthesia.*—According to Harrar<sup>79</sup> pain is greatly relieved in 85 per cent of cases by rectal ether analgesia. He believes the Gwathmey method is the safest and most effective manner of relieving the pains of childbirth yet devised. (The Gwathmey procedure is not entirely harmless. Babies are sometimes born asphyxiated, labor may be too rapid, probably because of the quinine, and cervical lacerations occasionally are the result, and the lower bowel may become irritated. Furthermore, some individuals not only question a synergistic action between morphine and magnesium sulphate but also believe the combination to be harmful occasionally. In spite of all these disadvantages, however, the Gwathmey procedure is a definite advance in obstetrics and should be used for selected cases.)

Gellhorn<sup>80</sup> points out the occasions for, and the technic of, using local anesthesia in obstetrics. Cosgrove<sup>81</sup> favors the use of spinal anesthesia for obstetric work, and C. H. Davis<sup>82</sup> discusses the available methods for obstetric analgesia and anesthesia. In the first stage he prefers heroin, with pantopon as the next choice. In the second stage intermittent analgesia with nitrous oxide or ethylene with oxygen has proved of greatest value.

*Complications.*—Rosenstein<sup>83</sup> emphasizes that strong bearing-down efforts before there is complete dilatation favor the occurrence of cervical lacerations. Coudert<sup>84</sup> also discusses cervical tears and DeLee<sup>85</sup> presents two new ideas in the mechanism of cervical lacerations during labor. He describes three different forms of laceration and their treatment. Schickelé<sup>86</sup> believes there is an autonomic innervation of the cervix independent of that of the body of the uterus. For spasms of the lower uterine segment and cervix Fink<sup>87</sup> recommends expectancy to the general practitioner, and vaginal or transperitoneal cesarean section to the experienced obstetrician. Rucker<sup>88</sup> advocates adrenalin for the treatment of contraction-ring dystocia and he bases this recommendation upon hysterographic tracings and actual clinical experience with cases of contraction-ring dystocia. (Bourne and Burn came to the same conclusion in their work but they fail to mention Rucker's first observations<sup>89</sup> on adrenalin which were published in 1925. These observations are contrary to the old belief that adrenalin increases uterine contractions.)

Horner<sup>90</sup> analyzes 500 cases of bradytocia (slow labor), and gives very good advice concerning the treatment of such cases. Boorstein<sup>91</sup> reports six cases of separation of the symphysis pubis which were due to improperly directed forceps deliveries and Naujoks<sup>92</sup> reviews the literature on rupture and suppuration of the symphysis in spontaneous labor. A. B. Davis<sup>93</sup> reports 184 examples of rupture of the uterus which occurred in the New York Lying-In Hospital. Wilson<sup>94</sup> describes three cases of uterine rupture at the site of a previous cesarean scar while Doerffer<sup>95</sup> reports three and Thoma<sup>96</sup> one case of spontaneous rupture of the uterus. (Many things may be done to lower the incidence of rupture of the uterus but one is to perform the cervical cesarean section as a routine instead of the classic operation.)

*Operative Obstetrics.*—A report of 537 cases of gynoplastic repairs of old lacerations immediately following childbirth is made by Bubis<sup>97</sup> who is very enthusiastic about these operations. Titus<sup>98</sup> believes that episiotomy should be done if laceration appears inevitable. He also performs perineorrhaphy in multiparas immediately after labor if they have a relaxed pelvic floor and suffer an abrasion during labor. Cornell<sup>99</sup> gives in detail the technic of forceps delivery. Bachman<sup>100</sup> describes the use of the Barton forceps for which he believes there is a limited field especially in the rotation and traction of transverse arrests of the vertex in high and mid-pelvis. (These forceps like the Kielland forceps should be used only by an experienced obstetrician.)

Three cases of habitual breech presentation are reported by Reiprich<sup>101</sup> and a study of the fetal heart tones in breech presentations is presented by Biehle.<sup>102</sup> The latter found that whereas in head presentations there is a gradual slowing of the fetal heart for a few hours before delivery, in breech presentations there is an acceleration in the rate. The cause of this increase is stimulation of the splanchnic nerves produced by pressure of the baby's legs against the abdomen.

Gibberd<sup>103</sup> advocates prophylactic routine external cephalic version during pregnancy in cases of breech presentation. The same recommendation is made by Bartholomew<sup>104</sup> who believes the procedure is harmless and will reduce the incidence of breech deliveries 80-90 per cent with a corresponding reduction in fetal mortality and morbidity. Fruhinsholz<sup>105</sup> reports a case of fetal death following external version.



(There is no doubt that external cephalic version when properly performed is a most helpful procedure and will cause a reduction in fetal mortality.)

During 1925 one cesarean section was performed for every 217 deliveries in the city of Detroit, whereas in the hospitals of that city the incidence was 1 in 67.7 births. Welz<sup>106</sup> analyzed these operations and found a maternal mortality of 13 per cent and a fetal mortality of 11 per cent. The puerperal mortality rate for Detroit was 6.6 per 1000, while that following abdominal section was 130 per 1000. A similar study<sup>107</sup> was undertaken for the city of New Orleans by a committee of which King was chairman. During 1921-1926, in the hospitals of that city, 291 cesarean sections were performed and this represented an incidence of 1 in 56 deliveries. The maternal mortality was 16.1 per cent. However, in a total of 31 cervical cesarean sections there was not a single death. H. E. Miller<sup>108</sup> also reported these statistics but emphasized the fetal mortality which was 18.9 per cent. Montgomery<sup>109</sup> reports a maternal mortality of 16 per cent and a fetal mortality of 23.8 per cent in a series of classic cesarean sections. On the other hand, Schweitzer<sup>110</sup> had a maternal mortality of only 2.5 per cent and a fetal mortality of 4 per cent in 236 cervical cesarean operations. In a series of 159 operations Smith and Kelly<sup>111</sup> report a maternal mortality of 0.59 per cent. Thirty operations were of the cervical type and the one death occurred in this group. Constantinesco<sup>112</sup> found a mortality of 18.7 per cent for classic cesareans and 7.1 per cent for cervical operations. (The above figures demonstrate the superiority of the cervical operations.) Zangemeister<sup>113</sup> urges that cesarean section be performed early in labor because of the danger of infection. Wagner<sup>114</sup> reports four cases of cesarean section performed by the exteriorization method of Portes (it should be called the Gottschalk operation) but the results were not satisfactory. Phaneuf<sup>115</sup> reports a case and describes the technic of this operation. (This operation may be employed when the uterus is to be preserved and the only other alternative would be craniotomy on a living child. Where the uterus can be sacrificed with impunity, a Porro operation and not the exteriorization operation should be performed in definitely infected cases.) Solomons<sup>116</sup> gives his reasons for believing that the lower segment operation is the one of choice. A new method of performing cesarean section is presented by Brodhead, Langrock and Cassasa.<sup>117</sup> (This operation was done by Lestouquoy<sup>118</sup> in 1857.)

Phaneuf<sup>119</sup> reports 25 operations in which he employed the transverse cervical incision. (The transverse incision permits an easier extraction of the baby's head but the danger of hemorrhage from extension of the incision is greater than it is with the longitudinal incision.)

An excellent exposition of the question of cesarean section is given by Mosher<sup>120</sup> and the abuse of cesarean section is discussed by Jellett.<sup>121</sup> In 19 elective cesarean sections performed at the end of pregnancy and before rupture of the membranes, Harris and Brown<sup>122</sup> found the uterus to be uniformly sterile. The same was true of six cases in which the classic operation was performed within four hours of the onset of labor. However, in five patients on whom the classic section was performed six or more hours after the onset of labor, bacteria could be demonstrated in the lower uterine segment. These bacteriologic findings clearly show why the conservative section is safe only when performed at the time of election.

An analysis of 130 pregnancies subsequent to cesarean section in 96 patients is made by Rice.<sup>123</sup> There was only one rupture of the uterus. In a series of 41 repeated cervical cesarean operations Phaneuf<sup>124</sup> found perfect healing of the cervical scars and very few adhesions.

*Uterine Hemorrhage.*—Bill<sup>125</sup> proves the advantages of prophylactic blood transfusion and cesarean section in the treatment of placenta previa. In a series of 45 cases where transfusion and cesarean were not very frequent, the mortality was 11.1 per cent, whereas in a later series of 56 cases in which transfusion was frequently used and of which 71.4 per cent were delivered by cesarean section, there was only one death (1.78 per cent). Ramos and Basan,<sup>126</sup> and Ledoux<sup>127</sup> likewise believe that cesarean section is the ideal treatment for placenta previa. Frey<sup>128</sup> reports a mortality of 1.2 per cent in a series of 79 cesarean sections for placenta previa. Korthauer<sup>129</sup> found a maternal mortality of 6.9 per cent and a fetal mortality of 17.3 per cent for placenta previa treated by cesarean section and a maternal and fetal mortality of 11.9 per cent and 61.2 per cent, respectively, for those not treated by laparotomy. Brodhead and Langrock<sup>130</sup> favor version when the cervix is sufficiently dilated to admit the hand. Their maternal mortality was 10.9 per cent and fetal, 66.7 per cent. Irving<sup>131</sup> reports a maternal mortality of 3.5 per cent and a fetal mortality of 57.9 per cent in a series in which the methods of treatment were essentially metrecruris and Braxton Hicks version. Kerwin<sup>132</sup> points out the advantages of ligating the uterine arteries for the control of hemorrhage in placenta previa. (The above statistics indicate that cesarean section with the aid of blood transfusion is the best method of treating most cases of placenta previa.)

#### PUERPERIUM

*General.*—Very excellent and useful information concerning postpartum care is given by both Polak<sup>133</sup> and Watson.<sup>134</sup> (While most practitioners realize the importance of prenatal care, very few follow a routine during the postpartum period, either immediate or remote. A good deal of chronic illness may be avoided by proper postpartum care which should extend over a period of many months.)

*Sepsis.*—The biologic defense in puerperal infection is discussed by Findley<sup>135</sup> and special importance is attached to Hofbauer's study on the cellular defense in the parametrium. In a study of 221 deaths due to puerperal infection Hamblin<sup>136</sup> found that 59 per cent followed operative delivery and that 40 per cent of these were by cesarean section and 38 per cent by forceps. Brügelmann<sup>137</sup> studied 300 cases of puerperal sepsis. The mortality was 75 per cent and in 75 per cent of all the cases, metastases occurred. In 60 per cent thrombophlebitis was present. The organism most frequently found as the cause of the metastases was the anaerobic streptococcus putreficiens. Schwarz and Dieckmann<sup>138</sup> are likewise of the opinion that anaerobic streptococci play a considerable part in puerperal infection. However, they maintain that in most instances the infection caused by this organism remains confined to the endometrium, and that few of these cases develop thrombophlebitis when promptly treated. They believe that early in these infections, removal of the dead material from the uterus by a dull curette will do much to prevent the spread of the infection, and that in some cases of pelvic thrombophlebitis all the pelvic veins

should be ligated and the uterus and adnexa removed. (Most authorities believe such treatment to be meddlesome. The less done in puerperal sepsis the better.) Harris and Brown<sup>139</sup> describe a new organism, act. pseudoneerophorus, which may be a factor in the causation of puerperal infection. The studies of Téoumine<sup>140</sup> indicate that the blood platelets fluctuate regularly during the course of puerperal sepsis. An increase in number signifies strength in the protective mechanism, whereas a decrease in platelets indicates the reverse.

As soon as a puerperal woman shows signs of infection Thomson<sup>141</sup> gives alcohol in large amounts in the form of port wine, madeira wine, cognac and the like. In the Odessa clinic among 9458 labors there was only one death from sepsis. Brock<sup>142</sup> advises uterine irrigation with alcohol during the puerperium when fever is present and the infection is limited to the uterus. (How is one to tell whether the infection is limited to the uterus?) Andérodias and Balard<sup>143</sup> use local vaccination for the prevention and cure of puerperal infection. They place gauze saturated with vaccines into the uterine cavity and vagina.

#### THE NEWBORN

*Physiology.*—A human ovum approximately nineteen days old is described by Greenhill.<sup>144</sup> This is the youngest ovum reported in this country and the outstanding feature of it was the unusual amount of invasion of the decidua by the plasmodium.

DeLee<sup>145</sup> describes a watch and a clock devised as aids in counting fetal heart tones. Seitz<sup>146</sup> traced 680 children, half of whom were born spontaneously, up to their 14th year of life. He found a much higher death rate for the babies born by operative procedures even up to the end of the first year of life. Idiocy, epilepsy, paralysis and other afflictions seldom are due to prolonged, difficult or operative labors but are more often the result of bad heredity. (Many neurologists and pediatricians will take exception to the last statement.)

*Complications.*—Frey<sup>147</sup> showed that chloroform will relieve fetal asphyxia by relaxing the uterus. Waller<sup>148</sup> reports 80 cases of asphyxia in which chloroform was used. In 69 per cent, the heart tones returned to normal and the babies were born alive, spontaneously. In only 7.5 per cent was there a complete absence of effect and in these cases the cause of fetal distress was not severe uterine contractions but such factors as looping of the umbilical cord. A very interesting study on fetal cardiac arrhythmias is reported by Rihl and Weinberl.<sup>149</sup> They attach greater importance to the character of the fetal heart tones than to their rate. Faint and dull sounds indicate danger. They report three cases of fetal arrhythmias which persisted after birth and they emphasize that when a fetal heart irregularity is detected at the onset of labor, when the pains are weak and the membranes are intact and the head is movable, interference is not indicated because the cardiac irregularity arises in the fetal heart itself and not from the processes of labor.

Schmitt<sup>150</sup> denies the existence of regular fetal respiratory movements in utero and Dyrell<sup>151</sup> agrees with him. In the treatment of asphyxia neonatorum, Hazama<sup>152</sup> advises the intraspinal injection of iodolin while Israel<sup>153</sup> advocates the faradic current.

Stecher<sup>154</sup> examined the eyes of 22 babies born by cesarean section and he failed to find any retinal hemorrhages such as are seen in babies born per vaginam. In addition to cerebral hemorrhage Hook<sup>155</sup> found that infection, especially pneumonia following aspiration of in-

fectured fluid is an important factor in death of newborn babies. A personal experience is recorded by Gellhorn<sup>156</sup> where the usual dose of quinine was followed by intrauterine death of the child. Two analogous cases were communicated to him by other observers. (The reviewer knows of two additional cases.)

Falls<sup>157</sup> discusses the pathogenesis of pemphigus neonatorum, while Mahon<sup>158</sup> and also Convelaire<sup>159</sup> take up the subject of hereditary tuberculosis and the newborn of tuberculous mothers, respectively. Gammeltoft<sup>160</sup> analyzes the cases of syphilis in the Copenhagen clinic and comes to the conclusion that pregnant women with syphilis should be treated during pregnancy with salvarsan irrespective of the duration of the syphilis or whether the patient had been treated before pregnancy. In a series of 243 fetal autopsies performed by McCord,<sup>161</sup> the causes of death in the order of frequency was syphilis 57 per cent, cerebral hemorrhage and tentorial tears 13 per cent, prematurity 11 per cent, and toxemia of the mother 4 per cent. (The very high incidence of syphilis is explained by the fact that this report comes from a southern clinic where a large proportion of the patients are negroes.)

*The Placenta.*—Gold<sup>162</sup> found that before rupture of the membranes the reaction of the vagina was acid in 147 out of 152 cases and after rupture it was alkaline in every one of 167 patients. Fisher<sup>163</sup> tested 1400 patients in the same way but found the test to be unreliable in 3 per cent of the cases. If, however, the reaction is repeated at two-hour intervals and the reaction is acid both times the diagnosis of intact membranes may be made with certainty. Though the causes of the quantitative variation of the amniotic fluid are still unknown Taussig<sup>164</sup> believes that fetal monsters play a rôle in these changes. Sakuma<sup>165</sup> injected pigments into the ear veins of gravid rabbits and found that the passage of pigments into the amniotic fluid is not brought about by the excretion of the pigment on the part of the fetus but directly from the maternal body. Kosakae<sup>166</sup> found that the blood vessels of the placenta react to irrigations of pituitrin and adrenalin solutions in the same way as do the vessels of other organs. A very complete description of placenta circumvallata is given by Williams<sup>167</sup> who maintains that the essence of this abnormality lies in the restricted area of the chorionic plate, the folding of the membranes and the presence of a layer of decidua upon the extrachorionic portion of the fetal surface of the placenta. It is Siddall's<sup>168</sup> opinion that inflammation of the umbilical cord occurs frequently even where syphilis is satisfactorily ruled out.

#### MISCELLANEOUS

An editorial<sup>169</sup> is devoted to DeLee's view that child-bearing in the modern civilized woman has become an event in which many factors may be pathologic. Kosmak<sup>170</sup> discusses the fundamental training for obstetric nurses and proposes a condensed syllabus of theoretic and practical teaching. Ten lectures and ten practical demonstrations are outlined all of which can be given in a minimum of thirty hours. MacMurchy<sup>171</sup> informs us that in Canada the maternal mortality was 6 per 1000 of living births. Among the 1532 deaths, 418 were due to sepsis, 357 to hemorrhage, 344 to toxemia and 87 to long, hard labor. Of the 1532 women, 1302 had had no prenatal care. Mosher<sup>172</sup> takes up the question of maternal deaths and suggests certain practical remedies. Baker<sup>173</sup> discusses the prevention of both maternal and infant mortality and praises the Sheppard-Towner Law. Adair<sup>174</sup> re-

views Woodbury's report on maternal mortality. (All three authors lay great emphasis on the statement that the maternal mortality in the United States is higher than it is in almost any other civilized country in the world. Mosher says we are 14th from the top of 17 civilized nations in maternal welfare and that the only countries which have a worse record are Belgium, Spain and Switzerland. Baker informs us that we rank 17th among 18 nations and that the only country in which the maternal death rate exceeds ours is Chile. There is no doubt that the practice of obstetrics in the United States could and should be considerably improved but it seems not fair for authorities such as Mosher, Baker and Adair to broadcast that obstetrics in the United States is inferior to that in countries such as Russia and Italy. The fallacy in these statements lies in the fact that there is no international uniformity in collecting maternal morbidity and mortality statistics. Therefore, the death rates of the different countries cannot be compared. The Health Section of the League of Nations considered this matter important enough to call attention to it at the meeting of the American Medical Association which was held in Atlantic City in May, 1925, by posting a chart which bore the caption "International Incomparability of Mortality Statistics.")

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## Selected Abstracts

### Physiology of Pregnancy

**Wijsenbeek and Grevenstuk: Observations on the Movements of the Uterus.**  
Nederlandsch Tijdschrift voor Geneeskunde, 1922, ii, 2155.

Having observed the movements of the nonpregnant uterus of rabbits through a celluloid window sewed into the abdominal wall, these authors now observed the movements of the pregnant and puerperal uterus in the same way. Some animals were observed during the entire pregnancy, and it was found that the presence of the abdominal window in no way influenced the uterine movements. Observations were made with the animal on its back; these were not commenced until several days after the insertion of the window so as to exclude any influence the operation might have on the movements. In order to exclude any effect, such as fright, which the unnatural position might have on the animals, some were narcotized with urethan. It was observed, in fact, that excitement and similar psychic influences definitely caused a cessation of movement.

So long as pregnancy was not demonstrable, the movements were the same as those of the nonpregnant uterus, namely, regular slow peristaltic movements which traversed the uterus in both directions. After eight or ten days, when pregnancy was evident on account of definite swelling of the uterus, the movements decreased in frequency and became less ample, so that at the end of the second week they were practically absent.

In the second half of pregnancy, the duration of which is from twenty-eight to thirty days, there is again a change noticeable. At this time parts of the fetus are distinctly visible through the uterine wall, and the fetal movements may be readily observed. Such fetal movements as the drawing of a paw along the uterine wall usually excite uterine movements which move along the entire

length of the uterus. In the third week of pregnancy, the uterine movements again increase in number and amplitude, becoming stronger as pregnancy advances. The movements are again peristaltic in nature, but there are definite movements which take place over the dilated portions containing fetuses and do not extend to the nondilated portions. The movements of the two uterine horns are independent of each other.

In the case of a dead fetus, which is indicated by the more livid blue color of its dilated segment, the movements become much more violent.

Agreeing with de Snoo, these authors believe that the trophoblast has a definite inhibitory action on uterine movements, which recommence when the trophoblast has ceased to exist. In case the fetus dies, the trophoblast ceases to function earlier than when it disappears in the usual way. In this way they explain the fact that while movements are practically absent during the second week, they are quite active over a fetus which has died.

Preceding delivery, there was a series of active contractions corresponding to the period of dilatation in woman. During the period of expulsion the peristaltic movements traveled in both directions, being apparently somewhat stronger in the direction towards the cervix. In the reverse movements, the uterus seemed to advance, while the fetus remained stationary.

The puerperal uterus had a peculiar appearance. It was reddish, and during contractions, whitish yellow in color. There were present a number of longitudinal wrinkles or furrows as if the circular fibers were more firmly contracted. The movements again had the same characteristics as those of the nonpregnant uterus.

The presence of the windows and the corresponding defect in the abdominal wall in no way interfered with parturition.

R. E. WOBUS.

Westman, A.: A Contribution to the Question of the Transit of the Ovum From the Ovary to the Uterus in Rabbits. *Acta Obstetrica et Gynecologica Scandinavica*, 1926, v, Supplement.

The author first briefly reviews the topographic anatomy of the internal genital organs of different animals. Then follows an account of the different theories concerning the transit of the ovum from the ovary to the tube, and its transportation through the tube. By means of the abdominal window method, the author carried out investigations in rabbits. Observations were made on animals during their sexually quiescent period as well as during estrus and on fertilized animals. During the quiescent period, weak contractions were seen in the musculature of the mesotubarium, drawing the tube medially and caudally so that the ovary comes to be more or less enclosed in the bursa ovarica. Continuous contractions were also noted in the tubes.

During estrus fundamentally the same movements of tube and mesotubarium were observed, but the mesotubarial movements were very powerful and constricted the bursa ovarica considerably. The displacements of the tube and ovary caused the different surfaces of the ovary to slide along the fimbrial apparatus. Muscular contractions of the same type were observed twenty-four hours after fertilization, following which they became reduced in intensity and rhythm. They were considerably weaker during pregnancy than during the quiescent period.

The muscular activity of the tube and broad ligament is regulated by the ovary. The contractions are weak after castration or destruction of the ovarian follicles, and they are strongest during estrus, when ripe follicles are present.

Through alternate contractions and dilatations in the tube, a powerful suction is set up which draws ova that are present in the abdominal cavity into the tube. The transit of an ovum through the tube is probably chiefly due to the muscular contractions of the tube.

J. P. GREENHILL.



**Hirst and Long:** The Early Diagnosis of Pregnancy by Methods of Precision: Further Observations on Sugar Tolerance Tests. Final Report. The American Journal of Medical Sciences, 1926, clxxxi, 846.

In a review of the literature on the laboratory procedures for the early diagnosis of pregnancy, Hirst and Long have attempted to show the reliability of the several different methods. The first group of tests, embracing the Abderhalden reaction, Erede's anaphylactic reaction, Costa's novocaine-formalin reaction, Dienst's reaction, and the red blood corpuscle sedimentation test, purpose to prove the presence of a specific protein in the nature of a ferment circulating in the maternal blood. The second group, including the alimentary glycosuria test of Frank and Nothmann, the Roubitschek adrenalin test, and the phlorizin test, rely on the tendency toward glycosuria in the early months of pregnancy.

The writers consider the first group either as too complicated for practical purposes or unproved by further investigations. The Frank and Nothmann method has been somewhat modified and carried out by them in a series of 150 cases. Of 88 pregnant women 83 or 94 per cent reacted positively. In the 57 non-pregnant 92 per cent reacted negatively. They, therefore, conclude that: (1) The alimentary glycosuria test is the most reliable. (2) The test is as reliable as the Wassermann test for syphilis. (3) The test is useful and, if practiced routinely will aid, appreciably in the diagnosis of pregnancy before the gynecologic signs appear.

WILLIAM KERWIN.

**Adlersberg and Porges:** The Diagnosis of Pregnancy by Means of a Double Test of Alimentary Acetonuria and Glycosuria. Medizinische Klinik, 1926, xxii, 1760.

The authors combined the alimentary acetonuria test with the alimentary glycosuria test to detect early pregnancy. The tests are performed as follows:

After a rich, mixed diet, the patient is placed for one day on a carbohydrate-poor diet, such as the following: 200 grams of meat, from 2 to 5 eggs, 50 grams of cheese, 100 grams of butter, black coffee, tea, broth, and green vegetables. The next morning the urine is collected and tested for acetone by means of the Legal test. Then the patient is given two rolls, the equivalent of 80 grams of white bread and tea with 10 grams of saccharine in it. One hour and again two hours later the urine is tested for sugar.

Thirty pregnant women and 24 nonpregnant individuals were tested. All of the pregnant women gave a positive acetone reaction and had glycosuria. Of the 24 control patients only 2 showed acetonuria and 3 showed alimentary glycosuria. According to the authors, these results indicate that their combined test is the best yet devised for the detection of pregnancy in the early months.

J. P. GREENHILL.

**Hellmuth, K.:** Is the Interferometric Method of Diagnosing Pregnancy Specific in Its Present Form? Klinische Wochenschrift, 1926, v, 2406.

The author made 723 interferometric examinations in 362 cases in order to establish a diagnosis of pregnancy. In 53 cases of pregnancy between the sixth and tenth lunar months, 138 tests were 53 per cent negative. In 192 patients who were definitely not pregnant as borne out by subsequent examinations, 359 tests were made and 170 or 47 per cent were positive. The author concludes, therefore, that the interferometric tests are of no value, either in establishing a diagnosis of pregnancy or in ruling out a suspected pregnancy.

RALPH A. BISS.

**Kleesattel, H.:** The Diagnosis of Pregnancy and the Determination of Sex by Means of the Interferometer. Klinische Wochenschrift, 1926, v, 796.

The author attempts to corroborate the reports of Hirsch, Ritterhaus, and Streck which claimed that over 95 per cent of cases were correctly diagnosed as

to the existence or absence of pregnancy and also that the sex of the child could be determined. In the first series of cases in which Kleesattel attempted to establish an early absolute diagnosis of pregnancy by means of the interfereometer, the results were absolutely unreliable. In a second series of 13 women in the last weeks of pregnancy, he attempted to establish the sex of the fetus. Forty-three observations were made, and the results proved to be correct in only 61 per cent. He, therefore, discards the interfereometer as a means of establishing the diagnosis of pregnancy or as a means of determining the sex of the fetus.

RALPH A. REIS.

**Ask-Upmark, M. E.:** Is the Corpus Luteum Necessary for the Physiologic Completion of Pregnancy in the Human? *Acta Obstetrica et Gynecologica Scandinavica*, 1926, v, 211.

At the Lund clinic in 1903, a bilateral ovariectomy was performed. One of the removed ovaries contained a true corpus luteum of pregnancy, but pregnancy was not suspected before the operation. However, 269 days after the operation the patient delivered a live, full-term child. This case, according to the author, proves without doubt that the corpus luteum is not necessary for the continuation of pregnancy. Since 1903, according to reports in the literature, 51 patients were operated upon during the first two months of gestation, and four of these castrations were done during the first month. In 17 cases there occurred interruption of pregnancy, but 9 of these were not positively as the result of operation. The remaining cases support the author's contention that the corpus luteum is not necessary for the maintenance of pregnancy.

J. P. GREENHILL.

**Bohnen, P., and Borrmann, K.:** Studies of the Increase in Blood Volume in Pregnancy. *Archiv fuer Gynaekologie*, 1925, cxxvi, 144.

The authors used the Congo-red method of Griesbach and injected 10 c.c. of a 1 per cent aqueous solution of Congo-red intravenously and four minutes later removed 15 c.c. of blood from the other arm. This blood was defibrinated, centrifuged, and examined colorimetrically. The average in normal, healthy nonpregnant women was found to be 6.4 per cent. In normal healthy pregnant women, the blood volume was found to be 7.63 per cent during the first half of pregnancy, and 7.0 per cent at the tenth month. This decrease is probably due to the terminal increase in weight due to the increased edema.

RALPH A. REIS.

**Hellmuth, Karl:** Determination of the Calcium Content of the Maternal and Fetal Blood Serum. *Klinische Wochenschrift*, 1925, iv, 454.

The content of calcium in the fetal serum was in each case definitely higher than in the maternal serum. This difference is larger than can be accounted for by percentage of error of the Clark method. The age of the mother or the number of previous children do not alter the relation between the maternal and fetal readings.

ADAIR AND SAFFERT.

**Bock:** The Calcium Content of Serum in Pregnancy, Labor, and the Puerperium. *Klinische Wochenschrift*, 1927, vi, 1090.

Bock used the Kramer-Tisdell method of determining the amounts of calcium present in the blood serum in various stages of pregnancy, during labor, and also during the puerperium. This method is accurate and simple. In healthy nonpregnant women the average calcium content was 9.21 mg. per 100 c.c. of blood. In primiparae the average amount of calcium was 9.60 mg. per 100 c.c., in secundiparae 9.18 mg.; in the first stage of labor the average was 9.52 mg., in the second stage of labor 9.38 mg., in the third stage 9.23 mg., and between

the fifth and the seventh days postpartum, 9.57 mg. In the toxemias of pregnancy the calcium content averaged 8.73 mg. per 100 c.c.

From these determinations it is quite apparent that there is no change in the calcium concentration during the first pregnancy. The calcium contents drop at the onset of labor but not to the extent reported by Kehrer and others. It rises again during labor, and the changes during the first and second stages of labor are only slight. In the third stage and immediately thereafter the drop in serum calcium is marked. During the puerperium, however, the calcium gradually returns to normal. The author offers no explanation for the variations found.

RALPH A. REIS.

**Hetenyi, G., and Liebmann, S.: Examination of Calcium Regulation During Pregnancy.** *Medizinische Klinik*, 1925, xxi, 1929.

From a study of the blood of fourteen pregnant women the authors conclude that there is a diminution in the calcium content of the serum toward the end of pregnancy. The calcium which is in the blood of pregnant women is quickly taken up. This avidity may be due, first, to the calcium requirements of the fetus, and secondly, to a special affinity of the cells of the gravid woman. In a few cases there appears to be an increased renal permeability to calcium. The blood of the umbilical vein contains more calcium than that of the artery.

J. P. GREENHILL.

**Hellmuth, K.: Studies in the Distribution of Sugar in the Maternal and Fetal Circulation.** *Archiv fuer Gynaekologie*, 1926, cxxviii, 11.

The author used the Folin-Wu method of sugar determination. In 48 determinations on pregnant women the blood-sugar values were found to be normal with a definite and marked tendency toward a hypoglycemia during the eighth and ninth months of pregnancy. In 18 of the 25 determinations made during labor, the blood sugar rose considerably, the highest being 22.8 milligrams per 100 c.c. of blood. This hyperglycemia of labor is found not only in whole blood but also in the component parts of such blood; i.e., in the serum, the plasma, and in the erythrocytes. The sugar content in those cases which showed less than 180 mg. per 100 c.c. of blood was distributed proportionately between serum, plasma, and erythrocytes. On the other hand, those cases showing more than 180 mg. of sugar had the excess sugar in the plasma.

The fetal blood-sugar content was always lower than that found in the maternal circulation, the difference ranging from 9 to 84 mg. There was always found, however, a definite parallelism between the maternal and the fetal blood-sugar content.

RALPH A. REIS.

**Scontrino, A.: The Free and Combined Blood Sugar in the Field of Obstetrics and Gynecology.** *Archivio di Ostetricia e Ginecologia*, 1926, xiii, 97.

In determining the amounts of free and combined blood sugar, Scontrino used the micromethod of Bang. He finds that: (1) During pregnancy (normal) there is an increase in the amount of the free blood sugar during the first six months, with a corresponding decrease during the last three months. It might be as high as 1.67 at the sixth month and 0.68 at the ninth month. (2) During delivery the free blood sugar is increased as high as 1.61. (3) During the physiologic puerperium there are slight oscillations in the amount of free blood sugar, but it soon returns to normal. (4) In pregnancy complicated by albuminuria, the free blood sugar is diminished, as low as 0.76. (5) In pregnancy complicated by eclampsia, there is an increase in the amount of free blood sugar only during the attack. Before the attack there is usually a hypoglycemia. (6) In these patients having malignant tumors, the value of the free blood sugar is within

normal limits. (7) In the premenstrual period there is an increase in the free blood sugar as high as 1.06 and during the period of flow there occurs a return to normal.

In regard to combined blood sugar, he concludes that: (1) In the normal pregnancies and puerperium, the combined blood sugar runs parallel with the free blood sugar: i.e., a slight increase during the first six months of pregnancy, returning to normal by the ninth month. (2) During labor the amount of combined blood sugar varies slightly but averages about 0.50. (3) In pregnancy complicated by a slight amount of albumin, there is a slight variation from the normal, but during pregnancies complicated by a large amount of albumin, there is a marked diminution, as low as 0.37. (4) In eclampsia there is an increase during the attack. (5) There is a slight increase in the puerperium if it is febrile. (6) In vomiting of pregnancy it is within normal limits. (7) In malignant tumors it is within normal limits. (8) In the premenstrual period there is an increase before the flow appears, paralleling the increase in the free blood sugar.

J. M. PIERCE.

Enfinger, H., and Boder, C. W.: Pigment Metabolism of the Liver in Pregnancy. *Archiv fuer Gynaekologie*, 1926, cxxviii, 327.

The van der Bergh test was used, on account of its accuracy and simplicity, in determining liver function. There is no definite positive test in pregnancy, and the authors cannot concede a so-called "liver of pregnancy." The increased bilirubin content may be due to a changed function of the reticuloendothelial system. They do find, however, a "liver of labor," because over 50 per cent of the cases examined during labor showed a hyperbilirubinemia, which rapidly disappears during the puerperium.

A direct reaction by the van der Bergh method during pregnancy is indicative of a disordered liver function. In the toxemias of pregnancy, especially eclampsia and hyperemesis gravidarum, this test is an excellent prognostic aid, both as to severity and outcome of the condition present.

RALPH A. REIS.

Grzechowiak: Capillary Pressure, Particularly During Pregnancy and in the Puerperium. *Zeitschrift für Geburtshilfe und Gynäkologie*, 1924, lxxxvii, 128.

The author discusses the relationship which exists between capillary pressure and arterial pressure and describes various methods which have been devised to measure the former. His own measurements were made with the Kylin apparatus and showed an average normal value of 140 mm. of water in the nail-fold capillaries of the finger when the hand is held at a level 15 cm. below the clavicle.

In pathologic conditions there are marked variations from this normal. There is an increase in any condition of venous stasis, as in heart failure. In cachectic conditions, exhaustion and undernutrition, there is a decrease, and this also occurs in diabetes. In nephritis, although the arterial pressure is high, there is no change in capillary pressure unless decompensation sets in.

In pregnancy the capillary pressure is at first low; from then until the tenth month it is approximately normal; in the tenth month there is a striking decrease in pressure. After delivery there is a gradual increase in a number of days to normal or even slightly above normal.

In disease of the kidney during pregnancy the capillary pressure values are definitely and considerably increased. The same holds true for eclampsia. In these conditions, the increased pressure persisted for some time after the clinical manifestation had disappeared. This increased capillary pressure forms a simple mechanical explanation for the capillary hemorrhages which form so significant a part of the pathologic picture of eclampsia.

MARGARET SCHULZE.

**Runge, H.:** Venous Pressure in Pregnancy, Labor, and Puerperium. *Archiv fuer Gynaekologie*, 1924, cxxii, 142.

The author modified the method of Moritz and Tabora by substituting an intravenous needle for the capillary tube, and determined the venous pressure by introducing the needle directly into the vein under consideration. This needle was connected to a manometer. He, therefore, overcomes a discrepancy due to capillarity which often amounts to a 10 per cent error. This investigation was undertaken to determine the presence and extent of circulatory disturbances in the lower half of the body during pregnancy and labor. He finds differences in pressure between the cubital veins and the veins of the lower extremity in non-pregnant women. During pregnancy, the pressure in the cubital veins was unchanged, but the pressure in the veins of the lower extremities was increased, whether the subject was standing or lying down. The author stresses this point as being important evidence that the gravid uterus exerts direct pressure upon the large vessels leading from the lower extremities. This stasis makes for varicosities, especially when there is a constitutional predisposition. There was no increase in venous pressure found during the period of labor except during the expulsive stage.

RALPH A. REIS.

**Carulla:** Peripheral Venous Pressure in the Puerperal State. *Revista Española de Obstetricia y Ginecologia*, 1926, xi, 329.

In a small series of normal pregnant patients the author determined peripheral venous pressure as varying from 7 to 36 cm. of water, averaging 23.8 cm. This amounts to almost twice the average reading for the nonpregnant female patient, where the normal runs from 8 to 18 cm., with an average of 12. During the puerperium the figures were found to run from 8 to 19, averaging 12. From his study the author concludes that in normal pregnancy the peripheral venous pressure oscillates within wider limits than in the nonpregnant woman, and shows a marked tendency to run at a higher level. During the puerperium the pressure does not vary from the nonpregnant normal.

THOS. R. GOETHALS.

**Benda:** The Influence of Menstruation and Pregnancy on the Permeability of the Meninges. *Medizinische Klinik*, 1925, xxi, 1863.

The author verified the findings of Heelig that there is an increased permeability of the meninges at the beginning of menstruation. This is probably due to a hormone. Since the hormonal influence is much greater during pregnancy, Benda studied the permeability in 25 women early in pregnancy and in 100 women late in pregnancy. Three methods were used, the uranin, the Weil-Kafka hemolysin reaction, and the Walter bromine method. In the first half of pregnancy no change in permeability was found. However, in the second half of pregnancy, and especially during labor, there was a markedly increased permeability in most of the cases. The increase is more frequent and more pronounced in primiparas. The return to normal did not occur until from four to six weeks after labor. In the presence of toxemia of pregnancy the permeability was greater than is usual during pregnancy. The barrier which is broken down is most likely the wall of the meningeal blood vessels. If this be true, then this injury to the meningeal blood vessels is only part of a generalized injury to the capillary endothelium of the body, which Volhard, Parr, and others believe to be the cause of edema in pregnant women. Since the capillary system is an essential part of the reticulo-endothelial cell system which plays an important role in the protective mechanism of the patient, it appears that this protective mechanism can under certain conditions be unable to function.

J. P. GARRETT.

Sandiford, I., and Wheeler, T.: The Basal Metabolism Before, During, and After Pregnancy. *Journal of Biological Chemistry*, 1924, lxii, 329.

The writers show that the total energy production of a pregnant woman increases slightly, beginning at the middle of gestation, and finally reaches a maximum of approximately 20 per cent above her basal value before delivery. There is definite evidence that the rate of heat production of a unit mass of tissue of the normal organism is not materially changed during pregnancy, but that such increases as occur represent the heat production of the newly formed protoplasmic tissue, composed largely of the fetus and to a less extent of maternal tissue.

GROVER B. LIESE.

Mahnert, A.: Studies of the Effect of Iodothyroglobulin on Diuresis and Metabolism in Pregnancy. *Archiv fuer Gynaekologie*, 1925, cxxvi, 125.

The author used intravenous injections of iodothyroglobulin to study the metabolic changes in pregnant women with edema. Normal pregnancies as well those associated with some type of disease were used, if edema was present, in order to ascertain the effect of thyroid extract therapy upon kidney function and metabolism. The results obtained were rather unsatisfactory, as only a moderate percentage reacted favorably. Uric acid, urea, and sodium chloride excretion was increased in both normal and pathologic cases. There was also an increase found in the serum cholesterin and a decrease in the serum albumin. This was later followed by a decrease in serum cholesterin.

Mahnert agrees with Kraus that there is a hypothyroidism during pregnancy and shows the similarity between hypothyroidism in the nonpregnant state and the disturbances of water balance and metabolism found in pregnancy following injections of iodothyroglobulin. The terminal loss of weight in pregnancy is a similar reaction to that following thyroid treatment and is probably due to the increased function of the fetal endocrine system and especially the fetal thyroid.

RALPH A. REIS.

Klaften, E.: Internal Secretion, Basal Metabolism, and Protein Transformation in Pregnancy. *Archiv fuer Gynaekologie*, 1927, cxxix, 66.

For the past two years the author has conducted experiments with various extracts of the glands of internal secretion and studied the effects of their injection during pregnancy. His experiments have shown that placental extract stimulates metabolism. Thyroid extract stimulates the metabolism in the pregnant woman to a greater extent than in the nonpregnant. This thyroid stimulation is of great therapeutic value in combating the decreased protein metabolism which is always found in eclampsia. This work, therefore, offers a rational therapy for the eclamptic patient and places the heretofore empiric treatment of eclampsia by means of thyroid extract on a scientific basis. Ovarian extracts have the least effect on metabolism in pregnancy.

In ten cases suffering from the menopause due either to panhysterectomy or to radiation castration, the basal metabolism was found to be between 20 per cent and 40 per cent below normal.

RALPH A. REIS.

Garipuy, Lasalle, and Sendrail: Fetal and Thyroid Participation in the Elevation of Basal Metabolism During Pregnancy. *Gynécologie et Obstétrique*, 1926, xiii, 172.

The basal metabolism is always elevated in pregnancy. The maximum elevation, occurring toward the thirty-eighth week, is about 35 per cent. Following delivery, there is a rapid drop to about 15 per cent on the third day and to normal

on the seventh day. Since there is a similar constant elevation in hyperthyroidism, some observers conclude that the elevation in pregnancy is dependent on increased thyroid activity.

Multiple pregnancies show more than the usual increase in metabolic rate. Delivery and intrauterine death of the fetus cause an abrupt fall of the rate to normal. These factors point to another agency; namely, the direct influence of certain products of conception, acting as hormones similar in nature to those causing lactation, etc., activating nutritive exchanges, mobilizing reserves, and favoring their fixation by the fetal organism. Elevation of the basal metabolic rate would be only one of the effects of this hormone action.

Tests were carried out on 16 pregnant women, after a very careful investigation to determine the slightest clinical signs of hyperthyroidism. In addition, the effect of 1 mg. of intramuscular adrenin (test of Goetsch) on the pulse rate, and of 1 c.c. of hypophyseal extract (test of Claude and Porak) were tried. These are very sensitive tests for hyperthyroidism. The basal metabolic rate was carefully determined and found constantly elevated. Only one case showed clinical evidence of hyperthyroidism, and this was the only case in the series which gave positive results in the further tests. Thyroid extract (20 mg. per day) was given by mouth in several cases without significant reaction. The oculocardiac reflex, which is rarely normal in hyperthyroidism, was normal in these cases. On the basis of these findings, the author concludes that the elevation of the basal metabolic rate is a function of the action of certain products of pregnancy, acting independently, and not through the medium of a hyperthyroid condition.

GOODRICH C. SCHAUFFLER.

Mahnert, A.: Studies in Changes in Metabolism and Body Weight in Pregnancy. *Archiv fuer Gynaekologie*, 1924, cxxi, 620.

The author attempts to determine whether or not the increase in weight during pregnancy is due to a sparing of the nitrogen and to what extent the body components are involved in this process of nitrogen retention. Tests were made of the total metabolism in pregnant women from the fourth to the tenth lunar months, only those cases being studied which showed a gradual increase in weight. These cases showed a limitation of protein metabolism when fasting, and the oxygen combustion was decidedly decreased, since only 6 per cent of the calory requirement is furnished by the body protein. The oxidation of fats and carbohydrates was therefore greatly increased.

He then takes up the terminal loss in weight reported by Zangemeister and finds that it is due to an increase in protein metabolism, since it is not due to fetal loss in weight or to changes in water metabolism. He is unable, however, to determine the causes or the factors involved. He suggests that the cause may lie in the hypophysis and also in the possibility of a relationship between the tendency to eclampsia and nitrogen retention with a corresponding failure to lose weight.

RALPH A. REIS.

Kemper, W.: Terminal Loss in Weight in Pregnant Women. *Archiv fuer Gynaekologie*, 1924, cxxi, 604.

The method of Zangemeister for calculating the terminal loss of weight in pregnant women was used in this investigation. First, the average weight curve is established for normal pregnant women by calculating from the differences in the highest weights during the last weeks of pregnancy rather than by using the absolute weights. On this basis 98 per cent of all cases examined weighed less at the onset of labor than they did during pregnancy. The average loss in weight was one kilogram. This loss is maternal, since the fetus gains in weight

during the last few days. The author suggests, as the most simple explanation, an increase in the excretory function, the maternal organism excreting excessive fluids secreted during pregnancy. This latter may be due to the fact that the pregnant woman rests more during the last few days of pregnancy and this rest may stimulate the excretory processes of the body. The author also suggests that it may be due to lessened food intake, although he believes this to be less plausible, since the majority of women continue normal food consumption until the onset of labor.

RALPH A. REIS.

Hirsch, R.: Concerning the Terminal Loss of Weight in Pregnant Women. *Monatsschrift für Geburtshülfe und Gynäkologie*, 1924, lxxvii, 266.

Zangemeister has maintained that the pregnant woman usually reaches her greatest weight the third day before the onset of labor and that in the last few days of pregnancy there is an appreciable loss in weight (about two and a half pounds) in 98 per cent of pregnant women. Hirsch studied 170 women to determine the validity of this statement. The patients were weighed daily without clothes and under identical conditions. The author found that the greatest weight was reached on the sixth day before labor and that from the sixth to the fourth day the weight remained stationary. Then there was a fall in the weight so that when labor began, the average weight was about one pound less than it had been five days before labor. Unfortunately this information cannot be used to detect the onset of labor, because while it is true as an average of a large number of patients, it does not hold true for patients as individuals. Many women with marked loss of weight do not go into labor, whereas patients in whom there is no loss of weight might do it. The author believes that the hypophysis, which becomes active at the beginning of labor, is responsible for the terminal reduction in weight. He cites a patient who weighed two hundred pounds and who was treated for menorrhagia by radiation of the hypophysis. By the eighth day after radiation the patient had lost sixteen pounds.

J. P. GREENHILL.

Biehle, H.: Is the Loss of Weight at the End of Pregnancy a Sign of Impending Labor? *Monatsschrift für Geburtshülfe und Gynäkologie*, 1927, lxxvi, 107.

The author selected forty healthy pregnant women who had no edema and no albuminuria and weighed them twice every week during the last few days of pregnancy and daily during the last eight days before the calculated date of labor. He found a decrease in weight in twenty-five cases (63 per cent), hence he cannot support Zangemeister's contention that a loss of weight towards the end of pregnancy indicates the early advent of labor.

J. P. GREENHILL.

Krauter, R.: Renal Function and Pregnancy. *Archiv fuer Gynaekologie*, 1926, cxxviii, 467.

The author investigated the hydrogen-ion concentration of the urine in pregnancy in order to throw light on the regulating power of the kidneys on the acid-alkali equilibrium during pregnancy. He shows charts and graphs demonstrating the variations in the hydrogen-ion concentration of the urine during the various times of the day, during the different months of pregnancy, following various diets, and in cases of eclampsia.

The hydrogen-ion concentration is more stable in pregnancy than during the normal nongravid state. The administration of hydrochloric acid or of sodium bicarbonate failed to change this concentration of the urine during pregnancy, showing that the kidney function is impaired to the extent that the renal secretory powers are less flexible and less able to excrete excessive amounts of acid or alkali which may be present in the blood stream.

RALPH A. REIS.



Keiffer, H.: *The Physiology of the Amniotic Fluid*. Gynécologie et Obstétrique, 1925, xiv, 1.

By experiments on 60 newborn babies it was determined that icterus neonatorum could be entirely eliminated if the child was maintained at a temperature approximating that of the uterus, the coating of vernix not being removed. It was also noted that even heavy coats of vernix seemed to be absorbed by the skin of the infant in from eight to twelve hours following delivery. This finding led to the speculation that the vernix and perhaps the amniotic fluid might be important sources of nourishment to the fetus and newborn, and that the cholesterol content of the vernix might operate in the prevention of the hemolysis which causes the icterus.

The amniotic fluid is shown to be the product of the amniotic epithelium, which also secretes the grease of the vernix, the cells undergoing slow degenerative changes, and finally sealing off to form a part of the vernix and other greasy deposits on and beneath the amnion, in the fluid, and on the fetus. There is also elaborated protoplasmic or protein material, the nature of which is little understood. The skin of the fetus contributes to these substances only the desquamated epithelial cells, and perhaps a slight secretion from the sebaceous glands.

The high cholesterol content of the vernix seems to agree with the established conclusion that a large amount of cholesterol is furnished the fetus by the maternal blood stream and acts as an antagonist to certain toxic lipoids, as well as an antimicrobial agent. The author concludes that the cholesterol in the vernix is an important factor. Lanolin is suggested as an artificial substitute, meeting the requirements. Great stress is laid on the importance of putting the newborn infant instantly into a temperature approximating that of the uterus, and of allowing the vernix to be absorbed by the skin. GOODRICH C. SCHAUFFLER.

Sakuma, H.: *Supplementary Report of the Transportation of Coloring Substances into the Amniotic Fluid*. Japanese Journal of Obstetrics and Gynecology, 1927, x, 34 (June).

The results obtained in the author's experiments may be summed up as follows: (1) Out of seventeen acid and eight alkaline pigments, the following six passed into the amniotic fluid when injected into the ear vein of a gravid rabbit; trypan-red, trypan-blue, toluidin-blue, Congo-red, rose-Bengal, uranin. (2) The concentration of all the pigments in the amniotic fluid was weak. The highest was that of trypan-blue, which presented a concentration of 0.04 per cent five hours after injection. The other pigments showed merely a trace. (3) The time required for the passage of various pigments into the amniotic fluid indicates that the passage is very slow. (4) The pigments that positively pass into the fluid belong to the acid group. (5) The membranes, especially the amnion epithelium, are stained by trypan-blue, trypan-red, toluidin-blue, Congo-red, and rose-Bengal. The placenta is stained by these five positive pigments and by anilin-black; the umbilical cord by four positive pigments, namely, Congo-red, trypan-red, toluidin-blue and trypan-blue. The stains made by all of them are discernible with the naked eye. Trypan-blue can stain the stomach and the upper part of the intestines of the fetus light blue; this was the only recognizable case of the passage of pigment into the fetus. (6) Both in the case of the passage of pigment into the amniotic fluid and in the excretion of pigment by the mucous membrane of the normal uterus the results are the same with regard to the kind of pigments, the concentration of the pigments of passage, and the relative time required for the passage. (7) These facts indicate that the passage of pigment into the amniotic fluid is not brought about by the excretion of pigment on the part of the fetus, but occurs directly from the maternal body. J. P. GREENHILL.

## Correspondence

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*To the Editor:*

Following publication of my article in the January issue, page 89, on a new type of breast funnel, I received a letter from Dr. Edward Lasker from which I take the following quotations.

"I noticed a few incorrect statements which were evidently due to the fact that not all pertinent data had been placed at your disposal. As I know you will be interested in a correction of these statements which have appeared under your name, I am giving you the proper data below and should appreciate your authorizing the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY to publish them.

"I am the original inventor of the electric breast pump, and I did the developing work at the request and under the guidance of Dr. I. A. Abt. . . . The first experiments with a breast attachment having a bulbous enlargement at the end of the funnel I made in 1922. . . .

"In your article you mention Keith as the originator of the water power pump with the bulbous enlargement. The Patent Office declared an interference with our application when the patent for which Keith had applied came up for examination and our priority was established in the proceedings."

I would appreciate it if you could publish this letter in justice to Dr. Lasker for it is not my intention to give credit to Dr. Abt or Dr. Keith that is due to Dr. Lasker, as he has pointed out to me.

F. P. McNALLEY.

ST. LOUIS, MO., FEBRUARY 13, 1928.

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*To the Editor:*

In the February issue of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY of this year, I find a statement of Dr. H. D. Furniss in his discussion on Bullard and DuBois's report of a case of congenital dystopic pelvic kidney, which demands a reply.

Dr. Bullard stated in his paper that I had at times found it necessary on surgically readjusting the pelvic kidney to disentangle embarrassing renal blood vessels.

Dr. Furniss in his discussion warned his hearers of the danger involved in interfering with these blood vessels, stating that "the arteries that supply the kidney are all end arteries; there is no anastomosis between the different branches, and in disentangling these, if they have to be ligated, that much of the kidney substance is destroyed as the result of an infarct in the region supplied by these arteries." However true this may be in theory, it is not proved so in practice.

In a case reported by me before the American Gynecological Society in 1911, I disentangled vessels in the upper pole of a left dystopic kidney. The kidney was rotated so as to direct the hilum outward, and the accessory vessels held it in this position. In order to disentangle these vessels and allow the kidney to rotate into a normal position, it was necessary to sever and tie five or six branches, both on the proximal and on the distal sides, which entered the kidney. This kidney was not destroyed in part or in whole after replacement and continued to function normally. Its surgical replacement was a success as shown by roentgen examination.

In another case which came under my care, the kidney was held in the pelvis by two necessary arteries of considerable size. Both of these arteries had to be severed in order to replace the kidney in the lumbar region. The kidney met with no ill effects by the severing of the arteries, and its replacement was a success.

The third and most interesting case was one of double or fused kidney, which more than half filled the true pelvis, and prevented the uterus from rising. It could be felt above the plane of the anterior superior spine of the ilium. This seemed a hopeless case, as the vessels which supplied the lower portion of the fused mass passed under the kidney; around its external border; traversed its superior surface, and entered the lower hilum. These vessels prevented mobility, and I found it impossible to shift the fused mass from the lower to the upper pelvis until they were severed. When severed, I worked the fused mass into the false pelvis where it was successfully anchored.

This case is the best demonstration I can supply to show that these vessels can be severed without destruction to the kidney tissue and that the blood supply to the area cut off was secured from the upper vessel, as this patient had an uninterrupted recovery. She married within the year and gave birth to two children in the next three years. During the first six months of study, little or no urine came through the left ureter which drained the lower portion of the fused kidney, but this portion of the kidney functioned normally by the end of this time. How nature overcame the difficulties will have to be determined by one more skilled in physiology than I am.

DOUGAL BISSELL.

NEW YORK, MARCH 3, 1928.

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## ITEM

### MEDICAL CENTER IN NEW YORK BEGINS OPERATIONS

SLOANE HOSPITAL FOR WOMEN, THE OBSTETRIC AND GYNECOLOGIC  
SERVICE OF THIS GROUP AND THE PRESBYTERIAN HOSPITAL

**D**URING the month of March the new Medical Center of New York received its first patients. In this are located the Sloane Hospital for Women, the Squier Urological Clinic, and the Presbyterian Hospital.

The Sloane Hospital, well known for many years as the obstetric teaching unit of Columbia University, has already been "booked" to full capacity for its opening at the Medical Center some time during April. This institution will occupy three floors of this twenty-two story Presbyterian Hospital structure. The building is E-shaped, wards of twelve beds each taking up the three horizontal bars of the E. In the new Sloane Hospital there are also wards of four, five, and two beds as well as single rooms. Multiple nurseries, and bathing rooms are provided for the babies. There is a special section for septic patients and another for infectious cases. The Labor and Operating Suites are on a floor connected with gynecologic beds. In the Labor Suite are eight sound-proof labor rooms and a small clinical amphitheater.

A specially designed "Sloane Maternity" floor of the Harkness Pavilion provides for the private patients.

Dr. Benjamin P. Watson, who was formerly at the Edinburgh University in Scotland, is the Director of the new Sloane Hospital and the successor of the late Dr. W. E. Studdiford.

# The American Journal of Obstetrics and Gynecology

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## Original Communications

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### SEX DIFFERENCES IN THE PATHOLOGIC PICTURE OF SYPHILIS

FIRST JOSEPH PRICE LECTURE OF THE AMERICAN ASSOCIATION OF  
OBSTETRICIANS, GYNECOLOGISTS AND ABDOMINAL SURGEONS

BY ALDRED SCOTT WARTHIN, M.D., PH.D., ANN ARBOR, MICHIGAN  
*Professor of Pathology and Director of the Pathological Laboratories in the  
University of Michigan*

THAT sex plays an important rôle in determining the degree and quality of pathologic lesions and reactions to injury in the human species has long been recognized by students of nosogeny. Our textbooks, in considering the incidence of any given disease, commonly devote a paragraph to sex, as well as to age, race, occupation, and other factors bearing upon etiology or pathogenesis. In such paragraphs, not only are differences in the incidence of the given disease in the two sexes discussed, but also the modifications and variations in symptomatology, pathology and sequelae. Sex differences in the manifestations of disease thus recognized and classified are usually explained by, or attributed to, the differences in anatomic structure and physiologic functions of the primary and secondary sex organs, and to differences in occupation, dress, habits, and other factors of the environment. In recent years, the endocrinal secretions, as contributory or determining factors in the creation and maintenance of sex characters, have been accorded a prominent rôle. Beyond these explanations of sex differences we have hardly gone. Of broader biologic and constitutional, inheritable factors, sex-limited genetic biologic characters, we know almost nothing at present. It is of significance that we do know a little more about sex-limited genetic characters of a pathologic value than we do of the normal.

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NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

Let us very briefly review our knowledge as to normal sex differences. Studies upon lower forms of animal life make us believe that sex is determined through the gametes at the time of union of the two germ cells, sperm, and ovum, but is revealed only later in the development of the embryo, through the differentiation of ovary or testis. The old proverbs apply here: "Woman is what she is because of her ovaries alone," "The testis makes the man." These organs, the ovaries and testes, have a double function, endocrinal and spermatogenic. The endocrinal function is the first to become active, and in connection with the other endocrinal glands, hypophysis, thyroid, thymus, adrenals, and others, determines the general development of the body as well as of the sexual sphere. The first decade of life is chiefly that of constitution development; from the tenth year on the sexual development predominates. In this general development sex differences appear in height, shoulder breadth, heart and lungs, breadth of hips, musculature, distribution and amount of adipose tissue, pelvic diameters, pigmentation, growth of hair, voice, etc. The establishment of the spermatogenic function and ovulation marks a striking biologic difference in the two sexes; the female begins to ripen two years earlier than the male, and completes her puberty about four years earlier than the boy. Full maturity of development is usually reached by the female by twenty-four years of age; that of the male not until twenty-eight years. The fully developed sexes show still greater differences; in the male the animal qualities predominate; in the female the vegetative. Men show much greater variation in personality; women show the racial characters in a purer form. For this latter reason the female is much better adapted for race determination than the male. The female shows also a greater power of adaptation than does the male. For this reason she shows also a greater measure of evolutionistic progression than he. The smaller face and jaw, the lack of wisdom teeth, the retrogression of the little toe, and the longer index finger are more frequently seen in women than in men.

The primary biologic differences in the sexes are therefore genetic, constitutional and endocrinal; these are evolutionary. The secondary differences are those produced by the environment of domestication. Upon this combination of evolutionary and environmental factors must depend the differences also in reaction to injury. A given injurious agent may not produce the same lesion and subsequent reaction in the two sexes. In other words, the same disease may manifest itself very differently in the male and in the female. We are excluding here all of those affections of the male and female sex organs that are definitely connected with the structure and functions of these parts; and would consider only the biologic sex differences of reaction to a common cause of injury acting upon identical or homologous organs and tissues; as, for example, differences in reaction to the same para-

site, poison, or other extrinsic injurious etiologic agents of our common and important diseases.

Of all of the important plagues affecting mankind, no one shows greater differences of reaction and manifestation in the two sexes than does syphilis. In the four centuries in which we have had clinical knowledge of this infection, there has occurred one observation after another calling attention to these differences in the clinical picture of syphilis in the two sexes, practically always to the same end, a recognition of its milder quality in the female, of a certain degree of immunity possessed by the latter, and of its tendency to become latent in her during the child-bearing period, but revealing itself in her children. While these clinical facts are generally recognized and described in our textbooks, we possess practically no definite knowledge as to differences in the underlying pathologic pictures existing in the syphilitic male and female. Their observation has been clinical rather than pathologic. In my own pathologic studies of syphilis these differences in the quality and degree of the syphilitic lesions in the two sexes have impressed themselves upon me as very marked and possessing a very great significance, not only from the scientific standpoint, but also from that of the practical medical and sociologic points of view. These pathologic differences and variations can perhaps be best shown by a systematic comparison of the same localizations of spirochetes and the resulting lesions in male and female cases of syphilis. The chronologic development of the infection will be followed also in this comparative pathologic study. The comparative pathologic studies given here are based upon the microscopic study of the organs and tissues obtained from over fifteen hundred autopsies on subjects showing pathologic evidences of latent or active syphilis. Three-fourths of these cases were males, one-fourth females. In addition to the autopsy material, conclusions drawn from numerous diagnostic examinations of biopsies and operative material are incorporated. From an immense amount of such material, the views as to the pathology of the primary lesion of syphilitic processes in skin and mucous membranes, tonsils, lymphnodes, genital tract, and rectum have been chiefly developed. From the autopsy material the views concerning the incidence of lesions in the central nervous system, cardiovascular system and the other viscera have been built up.

#### COMPARATIVE PATHOLOGY OF SYPHILIS IN THE TWO SEXES

*Occurrence.*—It is stated by many writers that the incidence of syphilis in the female is much less than in the male. With this statement I cannot agree. The apparent difference is easily explained by the fact that many women are syphilitic but show no clinical signs of the infection. There are probably just as many carriers of *Spirocheta pallida* in the female as in the male, if not more; but by far the

greater number of female spirochete carriers are undiagnosed. Their total lack of symptoms, or the mildness of their disease, the relative rarity of neurosyphilis, severe cardiovascular syphilis, aneurysm, etc., in women, make the appearance of syphilitic women in the clinic much less frequent than is the case with males showing these severe forms of syphilis. Nevertheless, at autopsy, microscopic study of the viscera will reveal the fact that latent syphilis is also common in women, perhaps even more common than in males.

*Primary Lesion.*—The primary sore is much more frequently missed in women than in men, due in part to the different anatomic structure of the organs of copulation. Chancre d'emblée, or syphilis without a chancre, is very much more common in women than in men, and is undoubtedly much more frequent in them than is usually supposed. The nonformation of a chancre is probably the rule when the entrance of the spirochete into the tissues takes place through the cervical or

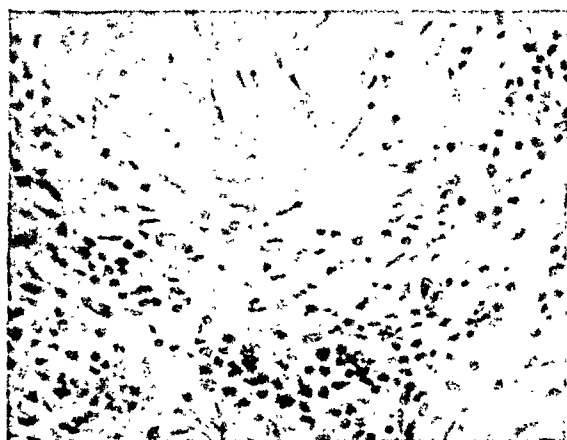


Fig. 1.—High power view of syphilitic perivascular infiltration, and infiltration that extended from primary lesion along the uterine vessels into broad ligament.

uterine columnar-celled mucosa. Diffuse granulomatous infiltrations without much induration are the only local lesions in such cases, and these may be discovered only on microscopic examination. Yet, the microscopic picture of what were probably primary lesions in the endometrium is very characteristic and repeats the pathologic characters of syphilis elsewhere in the body. There is the usual perivascular proliferation and infiltration of cells of mononuclear, lymphocyte, and plasma-cell type, and a progressive obliteration and new formation of capillaries. In primary syphilis of the endometrium the characteristic perivascular infiltrations may extend along the blood vessels throughout the uterine wall, lessening as the distance increases, even into the broad ligament (Fig. 1). Primary chancre on the squamous-celled vaginal portion of the cervix is, however, quite a different thing. There is marked induration with purplish-red discoloration, cauliflower appearance and eroded or ulcerated surface, the gross

appearances so closely resembling those of carcinoma, that the mistake is usually made by the clinician. Every case of primary chancre of the cervix that I have seen was either removed as a cancer or diagnosed in biopsies made on the suspicion of cancer; such large indurated chancres are rarely seen in the male. Similar ones, however, are found elsewhere; it is the usual form found on the nipple of the female breast, and here again the clinical diagnosis has always been carcinoma, and the breast and lymph nodes removed as such. The microscopic characteristics of the large chancres of the cervix are well shown in Figs. 2 and 3. The perivascular proliferations and indurations, giving a characteristic whorled appearance to the blood vessels, are clearly evident in the one focal plane. Upon the external genitalia the primary lesion in the female is in general much smaller and more atypical than in the male. Many women never know that they have such. Frequently

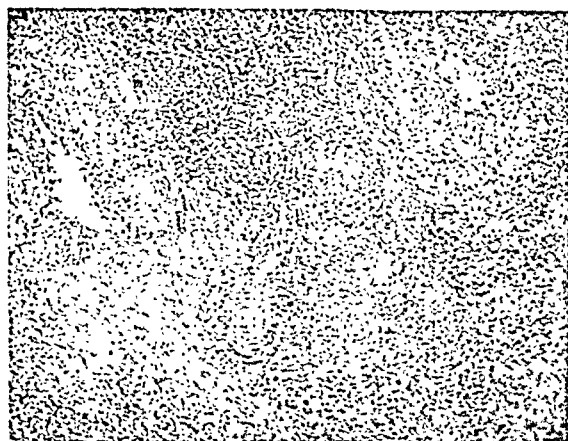


Fig. 2.—Low power view of primary cervical chancre, showing characteristic perivascular mantling with lymphocytes and plasma cells.

it is very ephemeral. The induration characteristic of the penile chancre is rarely present in the chancre of the labia. Still more inconspicuous are those on the fourchette. On the other hand, chancres of the clitoris and urethral meatus are often cauliflower-like, resembling those of the cervix and nipple, and may also be mistaken for carcinoma, and operated as such. Summing up the characters of the primary sore in women, it may be said that undoubtedly a very large number of these escape detection, either by the patient herself or her examining physician, that they are as a rule smaller, less indurated, and more fugitive in the female than in the male, and that syphilitic infection without chancre development occurs with probable frequency on columnar-celled mucosae. A striking exception to these most common characters is the occurrence upon the cervix, clitoris, urinary meatus, and nipple of hyperplastic cauliflower-like chancres usually mistaken clinically for carcinoma.



*Secondary Stage.*—As is the case with the primary lesion the cutaneous manifestations of early generalized syphilis are distinguished in general by their milder character in women. The skin lesions may be so slight that they are not noticed, or they may not appear at all. The latter is true particularly during the child-bearing period. Women who have had cutaneous lesions may develop them after the menopause, even when the infection is twenty or more years old. As to other constitutional symptoms in early syphilis, there appears to be in the statistics available upon this point some evidence that a greater preponderance of women show constitutional symptoms than is the case with men (Fournier: 50 per cent of women and 25 per cent of men had constitutional symptoms from the time of the infection; Stokes: 63 per cent of women and 42 per cent of men). Even when there are no, or very few skin lesions, some women show a well-marked toxemia during this stage in the form of a slight remittent

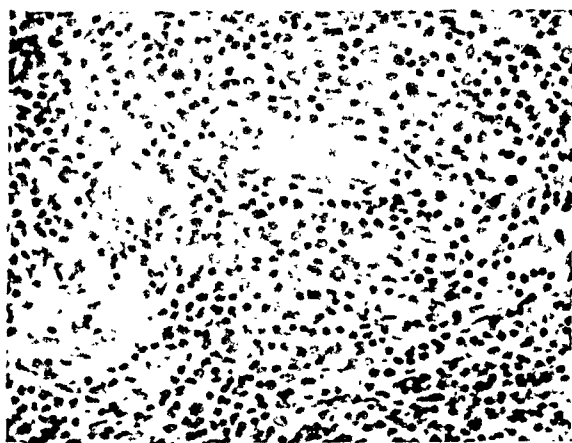


Fig. 3.—Higher power view of syphilitic infiltration and proliferation in primary cervical chancre.

fever that has been mistaken in some cases for malaria, typhoid, influenza, and rheumatic fever; the last named in particular, since it is often associated with the osseous, arthritic and myologic symptoms of early syphilis (so-called "syphilitic rheumatism" of Virchow and earlier writers) that are much more common in women than in men. Diffuse headache, ostealgia, sternalgia, and pleurodynia are very common in syphilitic women of this period, to a much greater degree than in men. An important point connected with this mistaken diagnosis of "rheumatic fever" in both male and female syphilitics, is that the real nature of later developing cardiac manifestations may be obscured and the myocardial affection wrongly diagnosed as "rheumatic" rather than as syphilitic. The syphilitic nature of those so-called rheumatic symptoms of early syphilis is frequently not recognized or even suspected by the practitioner. General malaise, nervousness, poorly defined gastric symptoms, and menstrual disturb-

ances also characterize this stage of syphilis in women. They also develop a well-marked anemia much more frequently than do men; a drop of 20 per cent in hemoglobin is not uncommon. The anemia is usually of the secondary type, and is associated with a relative and absolute lymphocytosis. Occasionally a chlorotic condition develops, a low hemoglobin with a normal red cell count. According to Stokes a moderate secondary anemia with lymphocytosis in women should always call for a Wassermann reaction, and a careful search for clinical signs of syphilis. Of very great importance, however, is the fact, not usually recognized, that a very large proportion of women in this stage of syphilis will give a negative Wassermann, thereby rendering the differential diagnosis much more difficult. In my experience both renal and hepatic involvements occur more frequently in women during the secondary stage than in men. The most marked cases of tubular degeneration associated with early constitutional syphilis that I have seen have been in women (nephrosis syphilitica). In such cases arsenical treatment is dangerous, and death may occur as the result. Later in the course of the secondary stage in women there frequently develops the lace-like pigmentary collar of the neck, consisting of nonpigmented areas (leucoderma colli, vitiligo) interlined or outlined with heavily pigmented areas. It may appear in the anterior axillary folds, and occasionally over the entire body and is more marked in brunettes than in blondes. This condition is very rare in the male. Many writers consider it pathognomonic of syphilis in women. It is not affected by treatment and may persist for years. It may be the only evidence of syphilitic infection that can be discovered in the patient. Syphilitic alopecia is also more common in men than in women. A slight icterus is also more frequently seen in syphilitic women than in men.

*Late Syphilis.*—In the majority of syphilitic women the disease becomes latent throughout the child-bearing period; there may be total absence of clinical symptoms, the general health may be good, and the Wassermann reaction may be constantly negative. Nevertheless, such a woman may repeatedly give birth to children with congenital syphilis, or may have successive abortions or miscarriages. In many instances the woman is sterile, but it is probable that this sterility is due to the husband's aspermatogenesis. Such latent cases may nevertheless be infective. At the time of the menopause and later, the Wassermann reaction may become positive, and clinical symptoms of the disease may appear. These late lesions differ greatly from those of late syphilis in the male. The central nervous system and the cardiovascular apparatus are much less frequently involved than in the male; on the other hand lesions of the liver, pancreas, adrenals, rectum, subcutaneous tissues, and periosteum are much more common in women. Many syphilitic women, however, go throughout the re-

mainder of their lives without one single suspicion of syphilis clinically, if they have no children or miscarriages. Nevertheless, the microscopic study of certain of the internal viscera at autopsy will betray the fact that the woman has been a spirochete carrier. The microscopic lesions of the female carrier show, however, a very great difference in localization and intensity from those of the male carrier of *Spirocheta pallida*. The chief differences in the pathologic picture of syphilis in the two sexes will be briefly outlined below.

*Cardiovascular System.*—Syphilitic lesions in the aorta and heart of the male can be demonstrated microscopically in practically 100 per cent of the cases, the lesions varying from very slight ones to those of very severe type. Very different is the case in the syphilitic female. In a large proportion of such, no characteristic gross or microscopic syphilitic lesions can be found in either aorta or heart; in others only the mildest forms of these lesions, clinically without



Fig. 4.—Aorta of male with latent syphilis. Usual type of aortic lesion in the male syphilitic. Compare with Figs. 5 and 6, showing the usual degree of the aortic lesion in the female latent syphilitic.

significance, but from the diagnostic standpoint of greatest importance, can be found, often only after extensive search, in the female aorta and heart. Severe syphilitic aortitis and myocarditis occur only in a small percentage of the cases, as compared to their very frequent occurrence in the male. According to Stokes, men with clinical cardiovascular syphilis outnumber women nearly four to one. In my autopsy material clinically important syphilis of the heart and aorta in the female has been relatively uncommon. Cases of severe syphilitic aortitis and myocarditis have occurred in this material. The majority of such cases have been in colored women; one of the most severe cases was in a very muscular, hard-working Irish scrub woman. One severe diffuse syphilitic myocarditis was seen in a young woman with congenital syphilis (father a tabetic); another severe case was found in a woman who had an exophthalmic goiter and died from

laryngeal diphtheria following partial thyroidectomy. No severe forms of acute syphilitic diffuse myocarditis have been seen in the female, against ten such cases in the male. There have been but two cases of syphilitic aortitis with aneurysm in this material. In the majority of syphilitic women microscopic lesions of syphilis when present in the aorta consist of very minute patches of fibrosis about the vasa vasorum extending up from the adventitia along these vessels into the media of the aorta. Small perivascular mononuclear or plasma-cell infiltrations may be usually found on prolonged search, but they are insignificant as compared with those found around the vasa vasorum in practically every male syphilitic aorta. The comparison of these average aortic lesions in the male and female is shown by Figs. 4, 5, and 6. The clinically unimportant myocardial lesions of latent syphilis in women consist of minute lymphocyte and plasma-cell infiltrations with local patches of fibrosis. Only one case of

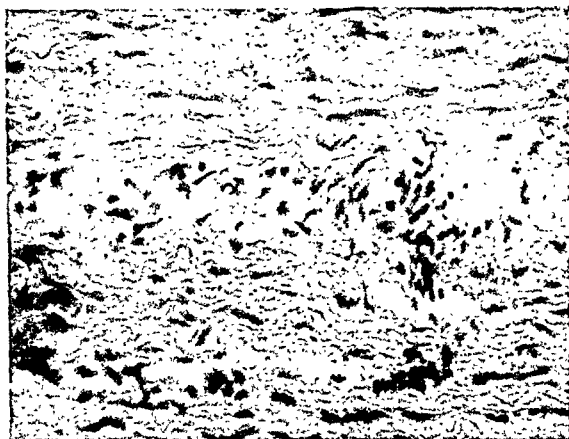


Fig. 5.—Slight syphilitic lesion around the vasa vasorum in middle-aged female with latent syphilis.

syphilis involving the aortic valve has been seen in the female, and this was also in a negress. Two cases of coronary artery syphilis with anginal symptoms associated with myocardial infarction are also included in our material. Two cases of asthma with syphilis of the pulmonary arteries and showing right ventricle preponderance and mild grade of polycythemia ("Ayerza's disease") have also been observed and studied. In general, it may be said that severe cardiovascular syphilis is rare in female latent syphilitics; but that just as severe forms as found in the male do occur occasionally, and that such cases usually show a racial disposition (negro) or are found in very hard-working muscular women. This suggests a possible relationship between the myocardial and aortic localization of syphilis and overuse of the cardiovascular apparatus due to frequent strain.

*Liver.*—On the other hand, the liver is much more frequently the seat of syphilitic localizations in women than in men. There are but

few opportunities for microscopic study of the liver in the early stages of constitutional syphilis, but in one case of a young woman dying from salvarsan poisoning in the roseolar stage, multiple focal necroses containing colonies of spirochetes were found throughout the liver (Fig. 7). In the later stages of the disease, particularly in the postmenopause period, severe hepatic lesions occur in women about twenty-five times as frequently as in men. The chief form is that of the *hepar lobatum*, the coarsely nodular or lobulated form of gummatous hepatitis; the constricted or depressed portions of the liver between the nodules being the result of cicatricial contraction following the healing of a gummatous hepatitis. A more or less patchy form of atrophic cirrhosis accompanies the gummata. The progress clinically of *hepar lobatum* in women of late middle age is very insidious. The great majority of our cases were not clinically diagnosed and the condition was discovered only on autopsy. Several

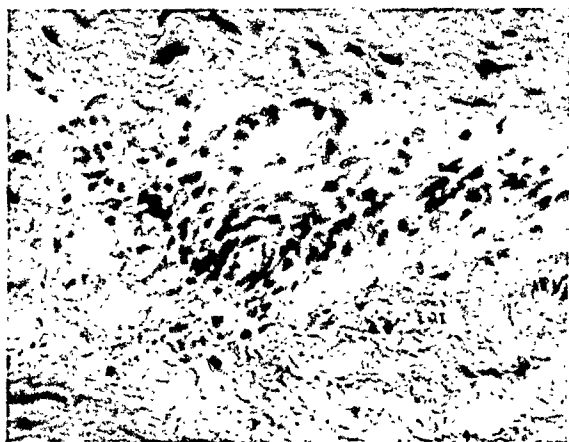


Fig. 6.—Slightly active syphilitic lesion in wall of one of the vasa vasorum of aorta in middle-aged female latent syphilitic.

cases were also revealed during operations performed for supposed gall bladder disease. Only one of our cases was diagnosed clinically antemortem, and this patient presented considerable ascites, icterus, and enlarged spleen. In many cases of *hepar lobatum* these clinical signs were absent or slight. A diffuse syphilitic cirrhosis of atrophic type is also seen developing in syphilitic women after the menopause, sometimes as late as after sixty years of age. In these individuals the aorta shows usually a more marked degree of syphilitic infiltration and fibrosis than the average female syphilitic presents. In the great majority of female latent syphilitics, however, the hepatic lesions consist, as in the male, of localized lymphocyte and plasma-cell infiltrations of the interlobular connective tissue, eventually fibrosis, associated with atrophy and chronic passive congestion (Fig. 8). The usual pathologic interpretation of such findings is that of an early cirrhosis. Between these mild degrees of syphilis of the liver and the

more severe forms of diffuse cirrhosis and *hepar lobatum*, all possible stages of transition may be found (Fig. 9). A more or less well-marked chronic perihepatitis, often with adhesions, is usually associated with such lesions. The gall bladder may be completely buried in such adhesions and the portal fissure obliterated. The scars of miliary gummas of the liver are very frequently found in old syphilitic women. They can usually be differentiated from healed tubercles by the fact that they show an area of localized atrophic cirrhosis about them, while this is wanting in the case of the tubercle. In general, it may be said that latent hepatic syphilis is much more common in women than in men, and of a more marked degree. Clinically, it escapes diagnosis, and even the most severe forms of *hepar lobatum* are usually not recognized until at autopsy. There is no well-defined clinical picture of hepatic syphilis.

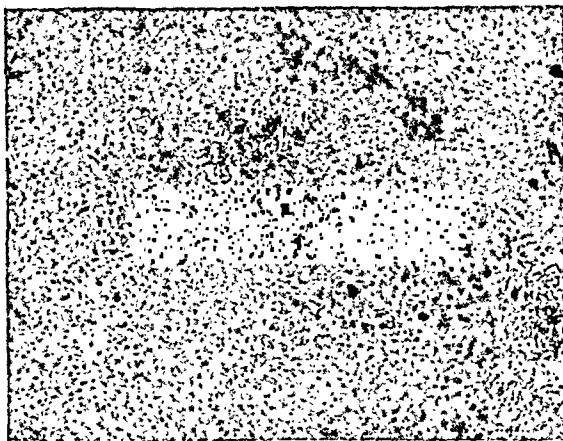


Fig. 7.—Focal necrosis in liver in sixth week of syphilis; early roseolar eruption. Female about twenty-five years of age. Large numbers of spirochetes were found in these areas.

*Spleen.*—In the early stages of hepatic syphilis the spleen is usually enlarged and more cellular; in the later stages it remains enlarged and becomes fibroid. A certain degree of perisplenitis is always present. Microscopically, there is a proliferation of the stroma and the reticulo-endothelium, and lymphoid atrophy. Scars of healed gummas may be found, but gumma of the spleen is not as common as that of the liver. In general, however, the condition of the spleen follows that of the liver; and splenic changes in latent syphilis are, therefore, more common in the female than in the male. All of our cases of gumma of the spleen have been in females.

*Gastrointestinal Tract.*—Syphilis of the stomach is rare enough in man, either clinically or pathologically, but it is very much rarer in women. Out of nine undoubted cases of syphilitic gastric ulcer, only one was in a female, and that one was a negress. In our experience syphilis of the intestinal tract is of importance in the female, in the

rectum alone. We have found it there nearly fifty times as frequently in the female as in the male. It is usually found in the fifth decade of life, and the majority of cases have been in women who have either had no clinical history of syphilis or have had syphilitic children or miscarriages. The symptoms are those of a localized stenosing induration of the rectal wall, usually fairly high, with superficial ulceration and extensive scarring of the mucosa. Occurring in the cancer age, the condition is almost always mistaken clinically for carcinoma, and we have seen the severe Kraske operation performed a number of times, when the correct diagnosis might have been made by a biopsy and microscopic examination. This is perhaps one of the most common pitfalls into which the rectal surgeon falls. The Wassermann reaction cannot be relied upon; the majority of women with rectal syphilis give a negative reaction; and a well-advanced cancer of the rectum may give a positive reaction in the absence of syphilis.



Fig. 8.—Active syphilis of liver in middle-aged female latent syphilitic. Negative Wassermann. No clinical symptoms. Localized process.

Some writers believe that syphilis of the rectum is rare; in our experience it has been rarely found in the male, but is not rare in the female. Microscopically, the syphilitic stricture of the rectum is characterized by a superficially ulcerating granulomatous induration of the submucosa extending into the muscularis. There is a new formation of blood vessels, perivascular infiltrations of lymphoid cells and plasma-cells; the lymph nodes are hyperplastic, germ centers are found throughout the intestinal wall, developing even in the muscle coats. Miliary gummas practically always are present, and the process is usually definitely gummatous in character, and is easily recognized by the microscopic characteristics. A biopsy and a therapeutic test should be made in every case of rectal stricture developing in a woman past middle life before a clinical diagnosis of cancer is made. While syphilitic rectal strictures appear to be so very much more common in women than in men, we have found in the latter much

more frequently gummatous ulcers and strictures of the colon. In every case these were diagnosed clinically as carcinoma. As to the occurrence of syphilis in the small intestine or appendix, we have practically no knowledge of its incidence in either male or female, or of its pathology.

*Pancreas.*—An interstitial pancreatitis leading to atrophy and fibrosis of the pancreas, with fibrosis of the islands of Langerhans, and associated with diabetes in some cases, occurs in both men and women with latent syphilis (Fig. 10). Milder forms appear to be much more frequent in the female; in other words evidences of latent syphilis are more often seen in the pancreas of the female than in that of the male, although the severity of the lesion is probably of no great clinical importance.

*Adrenals.*—Small foci of lymphocyte and plasma-cell infiltration occur in the adrenals in the great majority of latent syphilitics, male

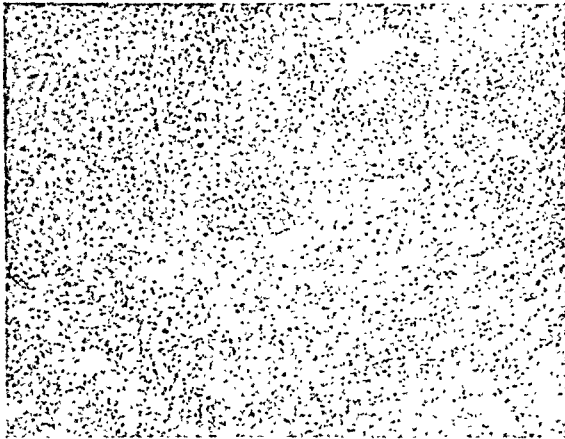


Fig. 9.—Severe syphilitic cirrhosis (hepar lobatum) in female syphilitic of fifty years of age. Condition discovered only on autopsy.

and female (Fig. 11). They may be found in any part of the gland, medulla or cortex, and are usually associated with a hyperplasia of the primitive lymph nodes of the adrenal medulla. They are usually more frequent and more marked in the adrenals of the female, and for this reason we have come to regard these as one of the important histologic criteria in deciding the presence of latent syphilis in the body of the female that shows no evidence of syphilis in either heart or aorta. In the more severe forms there is an interstitial adrenalitis, patchy or diffuse, and eventually a large part of the adrenal may become fibrosed with destruction of adrenal parenchyma (Fig. 12). Addison's disease might, therefore, be naturally expected to develop in the most severe forms of adrenal syphilis; and this we have noted in eight cases, but only one of these, curiously enough, was in a female, the others all being middle-aged males, with one exception, a young soldier of twenty-eight years of age. Gummatous adrenalitis is not



as common as the diffuse or focal interstitial form of syphilitic lesion; but the only cases of adrenal gumma we have seen have been in the female. Another point that we have noticed is an apparent association between the degree of adrenal syphilis and that of vitiligo. In all cases in which there was a marked leucoderma or vitiligo the syphilitic infiltrations in the adrenals have been marked. The more severe cases of adrenal syphilis are also characterized by small foci of lymphocytes and plasma-cell infiltration in the semilunar and periadrenal ganglia.

*Kidneys.*—We have never found any distinctive lesions in the kidneys of latent syphilis. There is an apparent higher incidence of renal fibrosis and contraction in the old syphilitic than in the nonsyphilitic, but it has not been possible to determine its relation to syphilis. No sex differences have been noted.

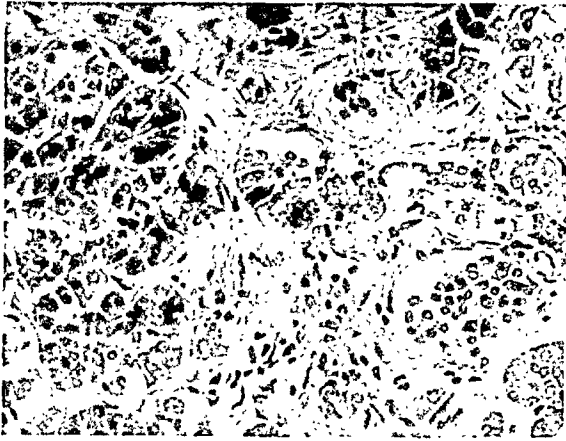


Fig. 10.—Syphilitic interstitial and intralobular pancreatitis in middle-aged syphilitic woman. Condition discovered only on autopsy. Negative Wassermann.

*Ovary.*—I have made microscopic examinations of thousands of ovaries in the course of thirty-five years of diagnostic pathologic work, and I have never seen a gumma of the ovary or any other lesion characteristic of syphilis. Either such lesions do not exist, or we are unable to recognize syphilis in the ovary with our present histologic criteria. This, perhaps, is one of the most striking differences in the pathologic picture of syphilis in the two sexes. The male sex gland, on the contrary, is practically always affected in latent syphilis in the form of an interstitial proliferation and plasma-cell infiltration leading eventually to the obliteration of the blood vessels and atrophy of the tubular epithelium; the tubules ultimately being replaced by hyaline thickenings of the basement membrane (orchitis fibrosa syphilitica chronica). This is one of the most constant marks of syphilitic infection in the male, and is never absent from any old latent case. It can be safely said that given a man's heart, aorta, and testes one can tell whether he has had syphilis or not; but given a

woman's heart, aorta, and ovaries little or no evidence as to this point could be gained. A very large proportion of women with latent syphilis will show no lesions in heart or aorta, and nothing can be found in the ovaries that can be recognized as syphilitic in nature.

*Tubes.*—I have had the same experience as far as the fallopian tubes are concerned. In a still greater number of tubes examined histologically no gumma or other recognizable syphilitic lesion has ever been seen. The only syphilitic changes ever seen in the broad



Fig. 11.—Small syphilitic infiltration in adrenal cortex in middle-aged female with latent syphilis.

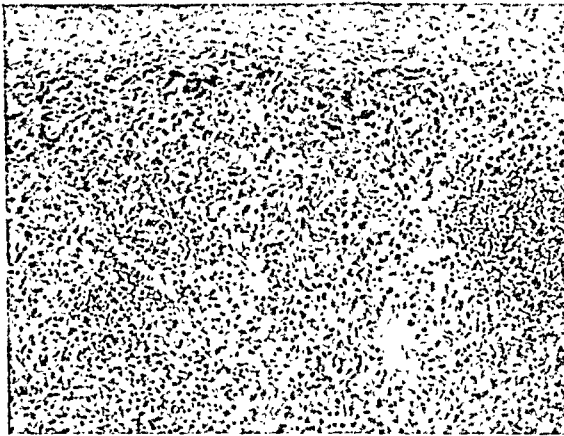


Fig. 12.—Severe syphilitic adrenalitis in middle-aged female syphilitic, associated with *hepar lobatum*.

ligament have been lymphocyte and plasma-cell infiltrations along the blood vessels extending from active primary lesions of endometrium and cervix.

*Uterus.*—Primary, secondary, and late syphilitic lesions have been seen on cervix and in endometrium, but in a very small proportion of cases compared to the great mass of material examined. I have never seen a gummatous lesion in the uterus. The primary lesions have already been described; the late lesions resemble these in kind, but vary in degree of intensity and in extent.

*Central Nervous System.*—The involvement of the central nervous system by syphilis shows a very marked sex difference, in that the female has a much higher degree of exemption than the male. It is generally stated that the incidence of paresis and tabes is 3 to 4 times more frequent in men than in women. Syphilis of the meninges, cerebrospinal syphilis of severe degree, cerebral and cord gumma, and severe vascular syphilis of the brain are also much less frequent in women. Autopsy studies, therefore, show much less involvement of the central nervous system in female latent syphilitics than in male. Chronic leptomeningitis, so commonly seen, almost universally, in the male latent case, is not often present in the female. Localized perivascular lymphocyte and plasma cell infiltrations in brain and cord are not nearly so frequently found in the ordinary latent case in the female, when no central nervous system clinical picture is present, as is the case in the male. Just as severe neurosyphilis may occur in women as in men, but the interesting and striking fact remains that this happens only about one-third as frequently as it does in the male. The central nervous system of the woman shows, therefore, a much greater immunity or resistance, to syphilis than that of man.

#### COMMENT

In summing up the differences in the pathology of syphilis in the two sexes, we find that the most striking facts presented are those bearing upon the relatively greater immunity of the female to this infection than the male possesses. This immunity is shown particularly in the case of the heart, aorta, central nervous system, and ovary. On the other hand, the pathologic lesions of latent syphilis in women are usually more extensive in the liver, pancreas, adrenals, and rectum than in men, but severe clinical forms of these visceral lesions are relatively infrequent when compared to the severe forms of cardiovascular and central nervous system syphilis in man. The general aspects of syphilis in the female, therefore, tend to be much milder than in the male. Woman's relatively greater immunity to syphilis is most strikingly shown during the child-bearing period. During this time she may have absolutely no clinical symptoms of syphilis, and the Wassermann reaction may be negative. Nevertheless, such an apparently normal woman may bring syphilitic children into the world, and the placenta, umbilical cord, and fetal tissues of her progeny may show spirochetes in enormous numbers. The production of a syphilitic child may be the only diagnostic fact that can be determined. Not until the menopause approaches may signs of syphilitic lesions and a positive Wassermann appear. It is this aspect of syphilis that makes the problem of this disease of such tremendous sociologic importance.

Many reasons have been advanced in explanation of this immunity in women: Differences in the character of the sera in the two sexes, that of women having greater protective power against the spirochete; greater degree of lymphocytosis in women; protective action of thyroid, and other endocrinal secretions; differences in habits of the two sexes; conceptional protection through chorionic proteins, etc. The facts stand out, however, that in addition to a general modification of the disease as affecting the body as a whole, there is also in the woman a marked localized resistance to syphilis in certain organs and tissues. It is difficult to explain the exemption of the ovary in any other way, when we know that the male sex gland has an especial susceptibility to syphilitic injury. It does not seem possible that we are missing evidences of syphilis in the ovary; it is much more reasonable to believe that syphilitic lesions do not occur in the ovary. If they do, they must be totally different from those we see in other organs. All in all, we can only surmise that there is some deep-seated biologic sex difference—a genetic, inherited, sex-limited resistance on the part of the ovary to the presence of the spirochete. It might be that the *Spirocheta pallida* is a pathogenic descendant of some harmless spirochetal form inhabiting the female body ages ago, and that in consequence woman establishes a more comfortable partnership with this organism than does man. Such a theory does not, however, explain a higher degree of immunity of the woman during the period of child-bearing, and the apparent increase of immunity as the result of conceptions. Whatever may be the explanation of woman's relative immunity to this infection, whether one or several of these factors contribute to it, the important fact remains that syphilis manifests itself in the female almost as if she were another animal species, and that about this sex-difference in reaction to infection with *Spirocheta pallida*, there center, not only grave sociologic problems, but also the most difficult practical problems in the diagnosis and treatment of syphilis.

## IS THE VAGINAL CESAREAN SECTION JUSTIFIED IN PLACENTA PREVIA?\*

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SOME time ago I read the following in an American textbook of Obstetrics concerning the treatment of the placenta previa: "The vaginal cesarean section has often been done in these cases, but in my experience quite unnecessarily, increasing rather than diminishing the risk, and often leaving the patient more or less disabled." And further: "I have no hesitation in saying that the man who finds it necessary to practice this procedure very often, while he may be proficient in surgery or in pure gynecology, is not a competent obstetrician."

There are no objections to be made to the first part of the quotation, but the latter part contains severe words which may, however, be modified a little. In any case I for my part believe that this question is too complicated to be settled by a categorical opinion. As I am very well acquainted with the significance of this Society as a competent forum for the discussion of questions of this kind, I am going to take your time for the discussion of the following question: Is the vaginal cesarean section justified in cases of placenta previa?

I need not remind this assembly that thirty years ago, when Lawson Tait suggested the abdominal cesarean section in certain cases of previa, it was here in the United States that this idea was adopted and spread far and wide. The principal reason for the abdominal section is that in case of severe hemorrhage there is no need to wait for the cervix to be distended by the uterine contractions, during which time the placenta gets more and more detached, and the hemorrhage continually increases. If the fetus and the placenta are removed by means of a cesarean section, the mother is spared the loss of blood, and the hemorrhage is more effectively checked than with the older obstetric methods through the vagina. It is quite generally agreed that in certain cases, cesarean section is the measure which often gives the best prospects both to mother and child. The difference of opinion now refers more to *how often* and *in what cases* it ought to be used.

Allow me to add that the operation should be performed only for the mother's sake regardless whether the child lives or is fit to live. With this point of view, I have considered it right to do abdominal cesarean section 20 times out of 207 cases of previa, and of these,

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3 times with the fetus already dead. The result was 19 living mothers, the twentieth died from embolism.

Let us now for a moment consider those reasons which argue against the vaginal cesarean section. In consequence of the situation of the placenta, the cervix is more filled with blood than usual, therefore also softer and more friable. Even a careful extraction of the fetus before the cervix is completely dilated easily produces a rupture of the cervix which might be fatal for a woman almost bled to death. It is for this reason that all the obstetric textbooks caution against the extraction after version, and that I myself in my lectures advise awaiting a spontaneous delivery.

If there is only one opinion in that matter, it would be doubtful, to say the least, to deliberately employ an incision in that very part which is so friable and plethoric; the hemorrhage must be inevitable and perhaps fatal.

Before going further, it is necessary to make one point especially clear. What I want to investigate here more closely is the eventual indications for the vaginal operation as compared with those of the abdominal route. There is one fact which seems to me both interesting and remarkable. Among those who reject the vaginal section and prefer the abdominal, there are some who condemn the *classic corporeal* section and in point of principle perform the *low cervical one*. Is not this a questionable choice? I, at any rate, find it difficult to understand why the hemorrhage should be less if the cervical section be performed from the abdomen than from the vagina. If there is a risk of a cervical incision from the vagina, it seems to me equally dangerous to perform it at this same place from the abdomen. The only difference I can imagine is that it is perhaps easier to control the bleeding by the abdominal cervical section than by the vaginal one. Personally, in doing an abdominal cesarean section for placenta, I always have done the classic operation because it seems to me more rational and less risky from the point of view of bleeding.

It is now of importance to consider the risk of hemorrhage at the vaginal cesarean section. This risk is indisputable, and it has happened in the hands of very eminent operators. Out of 12 similar operations, Bumm had a death from hemorrhage and therefore gave up the operation, Krönig and Sellheim did the same. Döderlein, who has performed the operation to the largest extent, and it can almost be said in point of principle, has in 194 sections for placenta previa a death rate of 9.2 per cent for the mothers, and it is certain that among these deaths, there are some caused by hemorrhage. Albeck, at Aarhus, who has performed 42 similar sections, has also a death rate of 9.5 per cent.

At present there are, however, more favorable figures which also ought to be stated. From the clinic in Lima, there were 14 cases

without a death among either mothers or children. At Halle there were 19 cases with 1 death, and from Elberfeld, Martin reports 28 such operations without any deaths for the mothers.

Out of my 207 previa cases, I have myself done vaginal cesarean section 27 times with 2 deaths among the mothers. It is important to give an account of the cause of death in these two cases. In one the incision in the cervix was not made sufficiently long and was ruptured still more at the extraction of the fetus without my observing it, with the result that this part of the rupture was not stitched up. At the autopsy it was found that from this place a hemorrhage had proceeded into the parametric tissue, which was certainly insignificant by itself but sufficient to cause the patient, already very anemic, to bleed to death. In the other case all went well to begin with, but the patient developed thrombosis, embolism and fever and died about a month after the labor from infection. It was found at autopsy that there was a rupture in the fornix vagina without a direct connection with the incision in the cervix and from this rupture the infection had penetrated into the parametrium.

In this case it is, therefore, not easy to judge whether death depended upon the operation or would have occurred after another interference as well; but I consider it only fair to presume that it depended upon the operation.

Is it then possible, guided by these cases and by what is known in literature, to judge where the risk of the operation at previa is to be found? According to my experience it does not depend upon the danger of hemorrhage from the section of the cervix. I have been surprised to find in my cases how slight this hemorrhage has been, in most cases not more severe than at an abdominal section. Nor have I found out that the wall of the cervix is especially friable. Those forceps which have been placed in the wall as the bladder is being pushed upwards and the incision prolonged, have not torn through the wall but grasped it steadily, and as I said before, I have the impression that the hemorrhage from the incision may very well be controlled.

I believe that the principal risk is to be found in the fact that the incision, to begin with, has not been carried sufficiently high up in the cervix. If this is not done, it is evident that it will easily tear further during the version and during the extraction of the head, especially if the latter is large. It is then difficult, not to say impossible, to control such a rupture and to suture it in an exact manner. In this connection I ought to mention a circumstance common to both my fatal cases and for which I reproach myself. In both I had done the version according to Braxton-Hicks, and it was my intention to let the labor finish spontaneously. While waiting for this a prolapse of the cord appeared, and in my desire to be able to save the

fetus as well, I performed the vaginal cesarean section while the leg thus filled up the vagina. I was not under the impression that this especially hampered the operation, but I understood afterwards that the body of the fetus, however, had been the cause of the incision not having been made sufficiently large.

The experience from Elberfeld, quoted a moment ago, also strengthens my supposition that the insufficiency of the section has been the real danger. They say there expressly that if the incision is only made sufficiently long at the beginning, there have never been any difficulties or complications.

And yet I must declare it as my opinion that the risk exists, and I confess without any hesitation and frankly that I have every time gone to the operation with a certain anxiety, and that I don't know myself if it has been the right thing to do or not.

We then come to another aspect of the matter which must be considered. Suppose we have a case which for some reason necessitates the speedy conclusion of the labor although the cervix is not yet dilated. Suppose again that an abdominal cesarean section is out of question on account of the mother's being infected or that vaginal examinations or other interferences have preceded which make the cleanness of the case questionable. What is then to be done? Dilatation by bags takes time and also is accompanied with certain difficulties; packing is out of the question, version cannot be performed as the cervix is closed. Is not then the vaginal cesarean section the only remaining resource?

In this connection I will remind you of the French view, especially of that of Brindeau, that a previa case, which has been bleeding for a long time, is often infected even though it has not been subjected to vaginal examination. The clot of blood which at a lasting hemorrhage fills the cervix down into the vagina changes the virulency of the vaginal bacteria, and a lingering infection arises. I have seen a few such cases where the infection without any previous vaginal examinations can hardly be explained in any other way.

The objection may be made that the above-mentioned cases are so rare that they can never be anything but an exception, and I also admit this unreservedly. It is enough, however, to agree here that such exceptions might occur, and in that case I for my part am of the opinion that we are entitled to resort to the vaginal section.

On the other hand, I am not certain that we are entitled to resort to the vaginal cesarean section merely to save the life of the fetus, although I have done it on some occasions with a good result. The two deaths, however, that I have reported, belong exactly to such cases where I performed the operation for the sake of the fetus, which I now repent. I acknowledge that the wretched results of the ordinary treatment in placenta previa ought to be improved for the fetus



as well, but if this improvement is to be obtained at the risk of the mother, then I don't agree to it. Remember that such mothers are usually multiparae, that their lives mean a great deal to the children already existing, and that in addition to this the fetus, whose life one tries to save, is often born prematurely and has suffered from the placental separation. My results with regard to the fetuses in the 27 operated cases are 5 dead out of 28 (once twins), or 17.7 per cent, if one may venture to calculate a percentage with such small numbers. The result is, however, better than with the ordinary obstetric methods. Once again, however, I wish to emphasize that it must not be done at the risk of the mother.

In conclusion I would summarize my views as follows: The vaginal cesarean section for placenta previa is a serious operation. The risk might above all be found in the possibility that the incision is not made sufficiently large to begin with, and, therefore, might rupture further at the extraction of the fetus, especially if the mother is at term and the head large. There may be cases, however, where it is important to bring the labor to an end although the cervix is not yet dilated, and where the abdominal cesarean section is contraindicated. It seems to me as if the vaginal section in similar cases deserves further trial before expressing a definite opinion as to its authorization or its indications.

*(For discussion, see page 716.)*

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Beckers, R.: A Case of Pregnancy Unrecognized Until Term. *Bruxelles Medical*, 1925, v, 843.

Beckers reports a case of a para iii, thirty years of age, whose menstrual periods had been regular and normal throughout pregnancy, the last period occurring twenty-four days before the onset of labor. The previous history was entirely negative. There was no history of nausea, no fetal movements had been felt, no breast changes noted, and the patient was entirely unconscious of her condition.

Twenty-three days following her last period there was a profuse gush of clear, thin watery fluid from the vagina. Because of this she entered the hospital for examination. The uterus was found to reach a little above the umbilicus. Fetal heart sounds could not be heard but there was a distinct maternal souffle. The following day the patient was delivered of a living child weighing 2720 gm. The placenta, cord, and membranes were normal.

Beckers points out that this case is interesting from an obstetric standpoint, because it shows that menstruation can continue throughout pregnancy. Also, if a mother can unknowingly carry her child to term, there arises an interesting medicolegal question so far as the responsibility of the physician is concerned.

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## THE THYROID GLAND IN PREGNANCY: A CLINICAL STUDY IN A REGION OF ENDEMIC GOITER

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IT IS quite generally accepted that the physiologic demands upon the thyroid gland are greater during pregnancy than in the non-pregnant state, and that this need for increased activity may lead to a so-called "physiologic enlargement" of the gland, particularly in the presence of an iodine deficiency in the diet. It is also a well-established clinical fact that many patients with goiter state that the gland enlargement first appeared during a pregnancy. Particularly, then, in regions of endemic goiter, where the incidence of thyroid enlargement may be 50 per cent or more of the total adult population, the rational administration of iodine prophylactically during pregnancy should be an important part of prenatal care.

It was believed that routine examinations of the thyroid glands in large consecutive series of pregnant women, some with and others without iodine prophylaxis, and of their newborn infants might throw some added light upon this problem. Consequently, all patients entering the obstetric department were submitted to a routine examination of the thyroid gland by the writer alone, in order to avoid the personal equation which might be introduced by several observers. A detailed thyroid note, such as is used in goiter clinics, was invariably made, and additional observations were added at monthly intervals throughout the pregnancy and during the puerperium. To facilitate the comparative study, iodine prophylaxis was given to approximately two-thirds of the patients, while the remainder received no such treatment. The necks of all newborns were examined and the presence or absence of thyroid enlargement was recorded on the mothers' charts. When the records were completed, the data were transferred to special cards for statistical study.

The essential data included age, number of previous pregnancies, complications of pregnancy and the puerperium, nativity, weight increase during gestation, original thyroid diagnosis and later observations, the presence of hypo- or hyperthyroidism, measurements of the neck, the findings on palpation of the thyroid gland, whether iodine prophylaxis was used during pregnancy, and the relative size of the infant's thyroid. No results were compiled until the series was completed.

Difficulty was encountered at first in adopting a working standard for the diagnosis of a normal thyroid gland. Criteria, such as non-palpable, palpable, and visible, as are used in certain goiter surveys, ob-

viously permit wide variation, and were not thought suitable for the problem at hand. Finally, it was decided to record the size of the thyroid mathematically by palpating the isthmus and estimating its thickness in centimeters. A description of the lobes was also added.

#### CLASSIFICATION

All symmetrical enlargements of the thyroid gland were recorded as colloid goiters, except those which showed definite clinical evidence of exophthalmic goiter, of which none were observed in these series. All cases were arranged into groups according to the following criteria:

1. Normal thyroid gland: Isthmus one-half centimeter or less in thickness, with no palpable enlargement of the lobes.
2. Small colloid goiter: Isthmus one-half to one centimeter in thickness, with a palpable symmetrical enlargement of the lobes.
3. Medium colloid goiter: Isthmus one to two centimeters in thickness, with a visible symmetrical enlargement of the lobes.
4. Large colloid goiter: All other symmetrical enlargements of the gland.
5. Adenomata: All nodular thyroid glands. Further classification of the adenomata was not attempted since it was of no special significance in this work.
6. Hyperplasia: Only patients with a definite clinical diagnosis of exophthalmic goiter. None were observed.

<i>STANDARDS USED IN DIAGNOSIS</i>	
<i>NORMAL THYROID</i>	<i>ISTHMUS 0.5 CM. OR LESS-LOBES SYMMETRICAL</i>
<i>COLLOID SMALL</i>	<i>ISTHMUS 0.5 TO 1 CM-LOBES SYMMETRICAL</i>
<i>COLLOID MEDIUM</i>	<i>ISTHMUS 1 TO 2 CM-LOBES SYMMETRICAL</i>
<i>COLLOID LARGE</i>	<i>ISTHMUS 2 CM + LOBES COLLOID</i>
<i>ADEKOMATA</i>	<i>ALL DEFINITELY PALPABLE</i>
<i>NEWBORN NORMAL</i>	<i>ISTHMUS TO 0.25 CM-LOBES BARELY PALPABLE</i>
<i>CONGENITAL GOITER</i>	<i>ISTHMUS 0.25 TO 0.5 CM-LOBES EASILY PALPABLE</i>

Chart 1.

The diagnosis of a normal thyroid gland in the newborn likewise proved difficult. Congenital goiters, as reported in the literature, are usually sufficiently large to be seen readily; but there were no criteria available for the diagnosis and classification of minor enlargements which are easily palpable but not visible. It was found that, by palpating the isthmus of the thyroid gland in the newborn, its approximate thickness in centimeters could be estimated with considerable accuracy. The weight of the human thyroid gland at birth is reported to vary from 0.7 to 5.5 grams.<sup>1</sup> It was possible in a few

cases to compare the findings on palpation with the actual weight and size of the glands removed at autopsy. From this experience, the following classification was evolved:

1. Normal thyroid gland: Isthmus one-fourth centimeter or less in thickness with lobes barely palpable.
2. Small congenital goiter: Isthmus one-fourth to one-half centimeter in thickness with lobes easily palpable but not visible.
3. Large congenital goiter: Visible thyroid enlargement.

#### INCIDENCE OF GOITER IN PREGNANCY

Nine hundred thirty-seven consecutive patients in the obstetric clinic were studied. Multiparas and primiparas were about evenly represented. The average age was twenty-nine years. The incidence of goitrous enlargement of the thyroid gland was 60 per cent, the distribution into the various clinical groups being given in Table I, and presented graphically in Chart 2.

TABLE I. THYROID DIAGNOSIS IN 937 PREGNANT WOMEN OBSERVED IN MICHIGAN

THYROID DIAGNOSIS	NO. OF CASES	PER CENT
Normal thyroid	373	39.8
Small colloid goiter	361	38.5
Medium colloid goiter	88	9.4
Large colloid goiter	23	2.5
Adenoma	92	9.8
Hyperplasia	0	0.0
	937	100.0

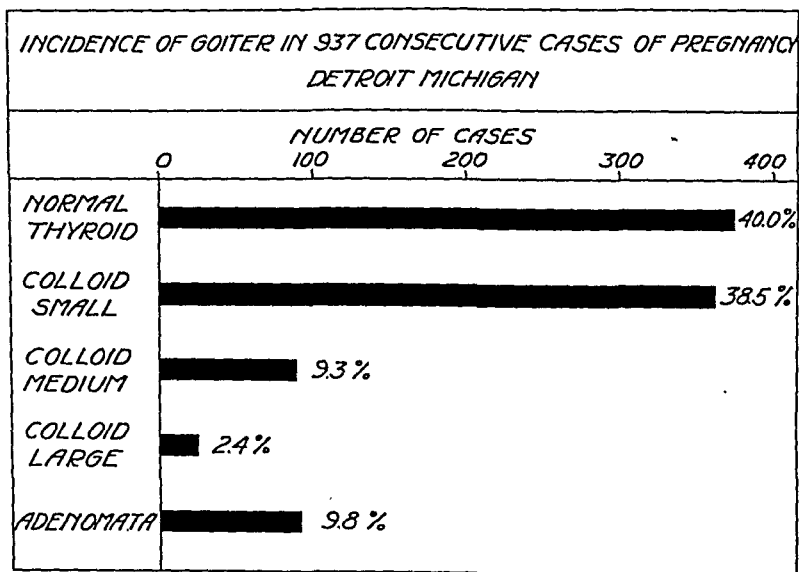


Chart 2.

Comparison of the incidence of goiter as here reported during pregnancy with the results of surveys made upon other groups of the population of Michigan reveals a close parallelism. Olin<sup>2</sup> found a goiter incidence of 42.2 per cent among 31,612 school children in four

Michigan counties. He further cites the work of Levin,<sup>3</sup> who, in a survey of 1,783 individuals in Lake Linden, Michigan, observed that 73 per cent had goiters; while Marsden and Romani found that 54 per cent of the population of Iron Mountain, Michigan, had perceptible enlargement of the thyroid gland.

It is of interest to compare the figures of incidence already given for pregnant women in Michigan with the results obtained from a study of a group of 213 pregnant women observed by the writer in obstetric clinics in Boston, New York, Baltimore, and Brooklyn. These latter results are arranged in Table II, and are shown graphically in Chart 3.

TABLE II. THE INCIDENCE OF GOITER AMONG 213 PREGNANT WOMEN OBSERVED IN BOSTON, NEW YORK, BALTIMORE, AND BROOKLYN

THYROID DIAGNOSIS	NO. OF CASES	PER CENT
Normal thyroid	161	75.6
Small colloid goiter	40	18.8
Medium colloid goiter	0	0.0
Large colloid goiter	3	1.4
Adenoma	9	4.2
Hyperplasia	0	0.0
	213	100.0

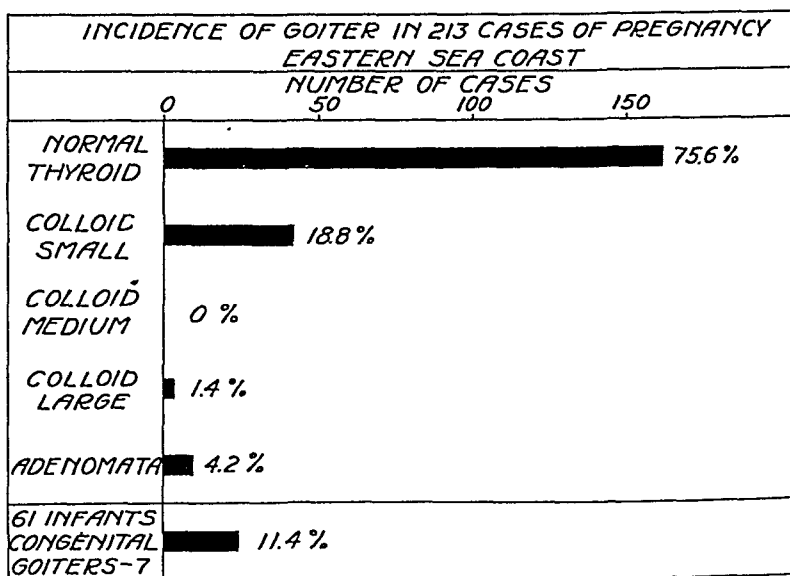


Chart 3.

#### NATIVITY

The place of birth was recorded in 688 patients of the group studied in Detroit. Approximately 20 per cent of these individuals had lived in a goiter belt for a relatively short time, i.e., one to three years. The effect of a lifetime residence in a goitrous district upon the type of change found in the thyroid gland as compared with the effect of a recent, short residence is shown in Table III.

TABLE III. RESIDENCE IN A GOITER BELT AND ITS RELATION TO GOITER AMONG 688 PREGNANT WOMEN

THYROID DIAGNOSIS	TOTAL CASES	GOITER BELT (LIFE)		GOITER BELT (1 TO 3 YEARS)	
		NO.	PER CENT	NO.	PER CENT
Normal thyroid	299	221	74	78	26
Small colloid goiter	239	191	80	48	20
Medium colloid goiter	67	62	92	5	8
Large colloid goiter	17	17	100	0	0
Adenoma	66	53	80	13	20
Hyperplasia	0	0	0	0	0
	688	544	80	144	20

It may be noted from this table that life-time residence in a goiter belt, as compared with a short residence therein, is associated with a very high incidence of clinical goiter.

#### PHYSIOLOGIC GOITER OF PREGNANCY

It is generally believed that there is an enlargement of the thyroid gland during pregnancy, and that such an hypertrophy is physiologic. This was first mentioned by Freund,<sup>4</sup> and later reported upon in greater detail by Lange.<sup>5</sup> These investigators demonstrated enlargement of the thyroid gland by making careful measurements of the neck at regular intervals during pregnancy in selected individuals with thin necks and with perceptible thyroid glands. Lange<sup>5</sup> observed an increased size beginning from the fourth to the sixth month and progressing steadily until delivery. This enlargement was followed by a rapid regression during the first two weeks of the puerperium.

In the present study, measurements of the neck were made at monthly intervals, but proved unreliable, except in patients with perceptible enlargement of preexisting goiters, since they were influenced by weight increases and by the slight generalized edema so frequently seen late in pregnancy.

#### PROPHYLACTIC IODINE

From the beginning of this study in 1923 until late in 1924 sodium iodide was employed as the prophylactic agent. This was given in solution, four grains a day for twelve days, a total quantity considered sufficient to saturate the thyroid gland with iodine.<sup>6</sup> Two such courses were given during pregnancy, the first as early in gestation as possible and the second at about the seventh lunar month. Sodium iodide was thus administered to certain patients with adenomata with no apparent ill effects.

In the spring of 1924, iodine salt was introduced into Michigan and about the middle of that year the use of sodium iodide was discontinued and all patients were advised to use iodine salt in their diets. Thus the latter half of the series received only iodine salt as a prophylactic agent. This method insures the intake of approximately

10 milligrams of iodine weekly, as advocated by Marine.<sup>7</sup> Iodine salt contains 0.02 per cent of iodine and is supposed to make the yearly ingestion of iodine somewhere between 300 and 700 milligrams, which is many times the theoretic normal adult requirement.<sup>7</sup> Variations in the amount of salt used in the diet would obviously vary the total iodine consumption within wide limits.

#### CONGENITAL GOITER

Data concerning the size of the thyroids of the newborns were compiled in two series according to the method of maternal iodine prophylaxis as outlined above. The first group includes all cases in 1923 and 1924, during which period the majority of mothers were given sodium iodide. Approximately one-third of the patients received no iodine, and a few in the latter part of 1924 used iodine salt. The second group includes all cases in 1925 when only iodine salt was employed as the prophylactic agent.

In the first group, there were 344 infants, of whom 120, or 34.9 per cent, showed evidence of congenital goiter during the first two weeks of life. Sixty-four per cent of the mothers in this group had had iodine prophylaxis, and it was found that mothers thus treated during the first half of pregnancy gave birth to infants with normal thyroids; while if treatment was started as late as the seventh month, it gave little or no protection to the fetus. Further analysis of the data showed that 60 per cent of the infants of mothers who had not received iodine prophylaxis had some thyroid enlargement, whereas when the mother had received treatment the incidence was only 20 per cent. Moreover, in the latter group, practically all the mothers had received their iodine treatment only in the last trimester of pregnancy, when it apparently gave very little protection to the fetal thyroid. It is of interest to note that the incidence of congenital goiter (60 per cent) in the offspring of mothers who did not receive prophylactic iodine corresponds with the incidence of endemic goiter in Michigan, as reported by Olin.<sup>2</sup> This suggests that endemic goiter may have its origin during intrauterine life.

In the second series, during 1925, striking results were noted from the use of iodine salt. Among the 230 newborns observed there were only 9 cases of congenital goiter, 3.9 per cent as compared with 34.9 per cent in the first series. In each of these nine cases the mother had a visible symmetrical enlargement of the thyroid. This observation suggests that pregnant women with the larger colloid goiters require more iodine than that afforded by iodine salt, if their offspring are to be protected adequately.

In this series, 83 per cent of the mothers used iodine salt throughout pregnancy, and it is believed that some of the remainder used it unknowingly, since it had been introduced generally in the stores and many people were unaware of its existence or of the reason for its use.

Data concerning the incidence of congenital goiter in the two series are presented graphically in Chart 4, and those regarding the incidence of congenital goiter in its relation to the clinical diagnosis made upon the maternal thyroid are given in Chart 5.

The incidence of congenital goiter among children of mothers who had had iodine prophylaxis was so closely restricted to those who had preceptible goiters that it would seem advisable to give these patients more iodine than that obtained from the iodine salt and therefore more than the theoretic requirement. This may be accomplished by giving a saturation dose of iodine twice during the pregnancy in addition to the use of iodine salt.

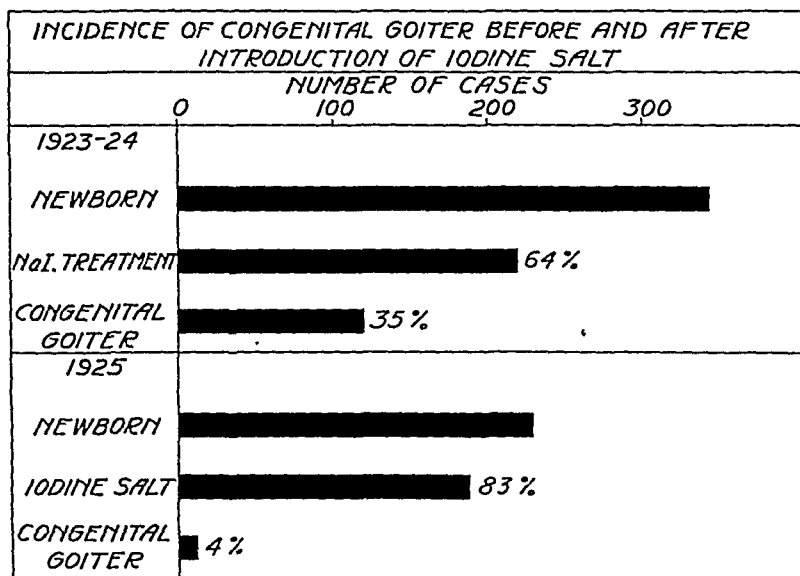


Chart 4.

Among 61 newborn children examined along the eastern seacoast, there were seven, or 11 per cent, with congenital goiter. This finding suggests that even in regions where goiter is not especially prevalent there may be an iodine deficiency during pregnancy.

These observations support the idea that gestation leads to increased demands on thyroid function, which may cause a functional hypertrophy of the gland, and indirectly lead to the development of congenital goiter in the infant, in patients where there is an iodine deficiency in the diet. This fact has been demonstrated experimentally on pregnant dogs by Halsted,<sup>9</sup> and was confirmed later by Marine and Lenhart.<sup>10</sup> The latter investigators showed that, when there was sufficient iodine in the diet, there was no increase in the size and no hyperplasia of the thyroids of their animals during pregnancy, and that the young did not show congenital goiter. Later, when these same animals were placed upon an iodine-deficient diet, the thyroid glands showed hyperplasia during pregnancy and some of the young had congenital goiters.



## HYPERTHYROIDISM

In the series of 937 patients examined in Detroit, a diagnosis of hyperthyroidism based upon clinical evidence was made in 35 individuals, an incidence of 3.7 per cent. No doubtful cases are included in this group, although it is believed that probably there were certain other cases of mild hyperthyroidism which could not easily be demonstrated by ordinary clinical methods. This belief is based upon the observation that in from 15 to 35 per cent of a series of patients upon whom basal metabolic studies were carried out there was a moderate elevation of the metabolic rate.\* This increased metabolic rate was apparently due to a slight hyperthyroidism without definitely recognizable clinical symptoms or findings.

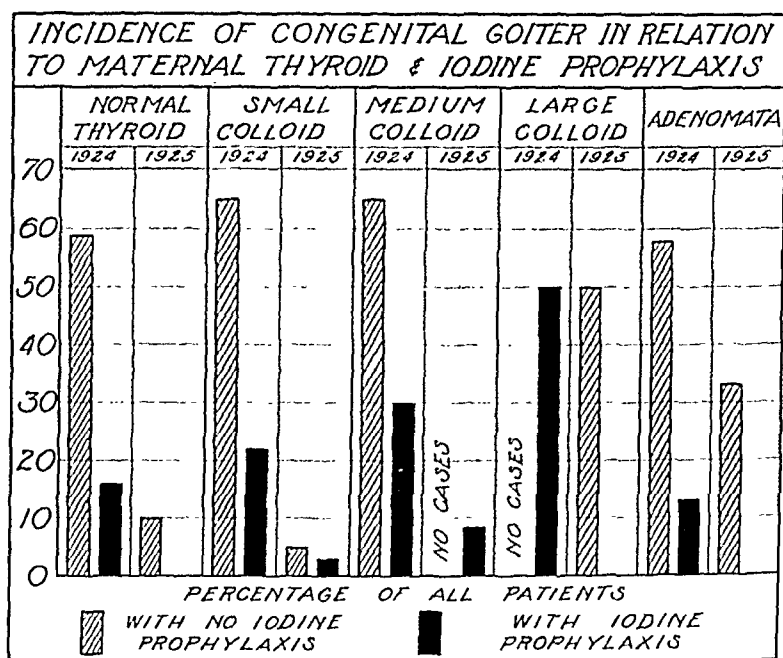


Chart 5.

Only one patient became sufficiently toxic to justify radical treatment. This was a woman with multiple adenomata in whom toxic symptoms began to increase at about the third month of the pregnancy, and by the fifth month had become so marked that hospitalization was necessary. When no improvement was noted after three weeks of medical treatment, thyroidectomy was performed. A rather severe reaction followed the operation, but the patient recovered and went to term.

Exophthalmic goiter is a rare complication of pregnancy, since the disease itself usually leads to sterility. Seitz,<sup>11</sup> in 1913, collected 112 cases of Graves' disease complicating pregnancy. Only 12 of these cases were found in the literature, the remaining 100 having been ob-

\*These observations will be published later.

tained by personal communications. Of the 112 patients, 7 died during pregnancy, 5 had therapeutic abortions performed, 11 had premature induction of labor, and 7 were subjected to thyroidectomy. Moreover, spontaneous abortion occurred three times, three pregnancies terminated with the birth of macerated fetuses, and in three others premature labor ensued. Seitz states that prompt improvement in the thyroid symptoms followed clinical abortion and premature induction of labor, although one death followed the former procedure. He concludes that the dangers of thyroidectomy are largely dependent upon the presence of a persistent thymus or of cardiac degeneration. In a study of 48 thyroidectomies performed during pregnancy, he found a mortality of 2 to 4 per cent, with 6 per cent of abortions following the operation. (With modern surgical technic the mortality rate should be less.) He favored thyroidectomy rather than clinical abortion, and this opinion seems to have been generally accepted.

It is our feeling that hyperthyroidism occurring during pregnancy should be treated conservatively except in patients with clinical symptoms of increasing severity, which endanger the life of the mother. In such individuals, surgical treatment of the thyroid is indicated rather than induced abortion. The danger that the operative procedure incident to the latter may precipitate a thyroid crisis must be considered. In one case, observed personally in another clinic, this happened, the patient dying within forty-eight hours after a therapeutic abortion at the third month for exophthalmic goiter. The dangers of delivery in cases of hyperthyroidism are due mainly to toxic myocarditis. Only those goiters which are giving symptoms of tracheal obstruction endanger life during labor by reason of acute enlargement due to congestion. The method of delivery at term of patients with severe grades of thyroid disease should be carefully chosen to impose the least strain upon the mother, in order that the major complications of toxic myocarditis and tracheal obstruction may be avoided.

#### CONCLUSIONS

1. Pregnancy causes increased demands upon thyroid function, and, when the diet is deficient in iodine, leads to hyperplasia of the gland, hyperthyroidism, and congenital goiter in the newborn. The so-called physiologic enlargement of the thyroid during pregnancy is in reality a pathologic hyperplasia, which may be prevented by the administration of sufficient iodine in the diet during pregnancy.

2. The incidence of goiter, 60 per cent, found in this series of pregnant women in Detroit compares closely with the results obtained in goiter surveys made upon the general population of Michigan.

3. The high incidence of congenital goiter, 60 per cent, in infants of mothers who did not receive iodine prophylaxis corresponds closely

to the general incidence of goiter in Michigan, and suggests that endemic goiter may have its origin in intrauterine life.

4. Measurement of the neck during pregnancy, as a means of determining enlargement of the thyroid gland, was found to be less accurate than palpation of the isthmus and estimation of its thickness in centimeters.

5. Iodine salt was found to be an ideal prophylactic agent in patients with normal or only slightly enlarged thyroid glands, but it is believed that additional iodine is advisable where visible symmetrical enlargements of the thyroid exist.

6. In some of the larger colloid goiters with an apparent increase in size of the gland during pregnancy, prophylactic iodine caused a perceptible and prompt decrease in size, with no further increase during gestation.

7. Before the introduction of iodine salt into Michigan and with 64 per cent of the mothers receiving sodium iodide prophylactically during pregnancy, 35 per cent of the newborn infants had congenital goiter. When no iodine was given the incidence of congenital goiter increased to 60 per cent.

8. Iodine given prophylactically only during the last third of pregnancy is of little value in the prevention of congenital goiter.

9. Following the introduction of iodine salt, the incidence of congenital goiter was reduced to 4 per cent. This reduction may probably be due to the use of prophylactic iodine earlier in pregnancy.

10. The incidence of maternal goiter, 25 per cent, found on the eastern seacoast, with 11 per cent congenital goiter, shows that even in regions where goiter is not endemic careful observation of the thyroid and rational prophylactic iodine administration during pregnancy would decrease the general incidence of goiter in these regions.

11. The treatment of hyperthyroidism during pregnancy should be conservative except in severe cases with increased toxicity in spite of iodine therapy, when thyroidectomy is indicated rather than therapeutic abortion.

It is a pleasure to acknowledge my appreciation to Dr. E. D. Plass for his many helpful suggestions during the course of this work.

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# PREMATURE SEPARATION OF THE PLACENTA

## A STATISTICAL REVIEW

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THIS study of the tabulated cases of premature separation of the placenta occurring at the Boston Lying-In Hospital during the eleven years, 1916 to 1926, inclusive, was originally undertaken for the purpose of arriving at conclusions as to the frequency of this complication of pregnancy and labor, the incidence of the commonly observed symptoms and signs of ablatio, the general mortality of the condition as affecting mother and newborn, and finally the relationship, if any, between this condition and the so-called toxemias of pregnancy.

No attempt is made here to undertake a review of the literature concerning ablatio placentae but the excellent article by Rudolph Holmes appearing in 1923, which discussed in detail the question in its relation to uteroplacental apoplexy, gave rise to the idea of comparing our series of cases, so far as available data would permit, with the series so thoroughly reported by him.

The eleven years reviewed yielded 128 delivered cases diagnosed before, during, or after labor as premature placental separation. This series does not include those patients who showed a small amount of bleeding at some time or times during pregnancy and who, in the absence of demonstrable placenta previa or other pathology, showed a recession of this symptom either without treatment or after a few days in bed, later being lost sight of or proceeding to a normal delivery some time afterward. All of the 128 cases reported were delivered, the diagnosis being made on the basis of clinical symptoms and signs which are discussed below.

*Incidence of Premature Separation.*—During this period of eleven years there were 11,907 hospital deliveries, which makes the incidence of ablatio at the Boston Lying-In one case in 93 or 94 deliveries, and which tallies almost exactly with the figures published by Cragin from Sloane. This finding is, however, relatively unimportant, like most statistics of the incidence of any obstetric pathology in a maternity clinic which receives, as this one does, a heavy increment of emergency cases sent in by the community at large for the treatment of various abnormalities.

*Low Attached Placenta.*—Eight of the cases revealed, on pelvic examination, the presence of a low attached placenta. This survey does not pretend to determine the propriety of this diagnosis nor to dis-

TABLE I. OUTLINE OF THE CASES IN SERIES

Year	1916	17	18	19	20	21	22	23	24	25	26	Not. rec.	Totals
Cases	12	5	9	8	10	14	11	8	19	11	21		128
Gravid.													
Primi-	3	1	1	5	2	5	2	2	7	4	7		39
Multi-	9	4	8	3	8	9	9	6	12	7	14		89 128
Age													
16-19													9
20-24													26
25-29													33
30-34													24
35-39													23
40-46													13 128
Gestation													
Term	4	4	5	5	8	3	3	1	7	6	5		51
8 mo.	5	0	1	0	0	8	4	5	4	3	4		34
7 mo.	2	1	1	2	1	1	3	1	4	0	5		21
6 mo.	0	0	1	0	1	1	1	1	1	0	4	9 cases	10
5 mo.	0	0	0	1	0	1	0	0	0	0	0		2
4 mo.	0	0	0	0	0	0	0	0	0	1	0		1 119
Primary Symptom													
Labor	4	0	2	3	3	2	2	1	5	4	4		30
Pain	1	0	0	0	1	3	0	0	3	2	1		11
Hemorrhage	7	5	5	5	5	7	8	7	9	4	12		74
Lab. & Pain	0	0	0	0	0	1	0	0	0	0	0	3 cases	1
Lab. & Hem.	0	0	1	0	1	0	1	0	1	1	1		6
Pain & Hem.	0	0	1	0	0	1	0	0	0	0	1		3 125
Hemorrhage													
Concealed	0	0	0	1	1	2	0	0	5	0	0		9
Frank	12	5	9	7	9	12	11	8	13	9	21	3 cases	116 125
Etiology													
Nontoxemic	9	5	8	8	7	9	7	5	13	7	13		91
Toxemic	2	0	1	0	3	5	4	2	4	3	7		31
Eclamptic	1	0	0	0	0	0	0	1	2	1	1		6 128
Uterus													
Rigid	4	0	1	3	3	7	2	2	3	3	6		34
Boardlike	0	0	1	1	1	0	2	0	1	1	1	11 cases	8
Not relaxing	2	0	0	0	1	3	1	1	3	1	1		13
Relaxed	5	4	6	4	5	3	5	3	11	3	13		62 117
Delivery													
Pelvic	12	5	8	6	9	7	7	4	12	5	14		89
Abdominal	0	0	1	2	1	7	4	4	7	6	7		39 128
Ablatio	12	5	9	8	10	12	9	6	15	10	19		115
Apoplexy	0	0	0	0	0	2	2	2	4	1	1	1 case	12 127
Detachment													
Complete	4	1	2	5	2	6	3	3	4	2	3		35
Incomplete	5	3	3	0	6	5	7	1	11	5	9	38 cases	55 90
Maternal													
Recovery	11	5	8	6	10	14	9	6	17	10	21		117
Death	1	0	1	2	0	0	2	2	2	1	0		11 128
Fetal													
Recovery	5	3	4	4	2	5	5	2	9	5	6		50
Death	8*	2	5	4	8	10*	6	6	10	6	15		80 130

\*Two cases of twin pregnancy.

discuss the possibility that some of them might have been more correctly classed as placenta previa; it assumes that had the operator considered such a case to be a previa he would have so signified in his description of the findings; hence the eight cases are included with the others, where, for want of definite evidence to the contrary, the placenta was assumed to have been normally implanted.

*General Tabulation of the Cases.*—See Table I, and discussion below.

*Parity of Patients.*—The series corroborates the general finding that ablatio is more common in multigravid than in primigravid women. Eighty-nine cases, or 69.5 per cent occurred in the former class, 39, or 30.5 per cent in the latter. Accepting Holmes' estimate that primiparous labors are to multiparous as one to three or four, the series indicates that by and large the primigravida runs the same risk of ablatio as does her multiparous sister. Of the multiparae studied 17 were para-2, 15 para-3, 8 para-4, 9 para-5, 12 para-6, 4 para-7, 5 para-8, 7 para-9, 3 para-10, 6 para-11, 2 para-13, and 1 para-14.

*Age Incidence.*—The age incidence of patients in whom this condition obtained was as follows: 16-19 inclusive, 9; 20-24, 26; 25-29, 33; 30-34, 24; 35-39, 23; 40-46, 13. The youngest patient was a primigravida of 16, the oldest a para-13 of 46. The finding that 68 patients were less than 30 years as contrasted with 60 of 30 years or over does not corroborate the suggestion of Holmes' series that the incidence is proportionately greater with advancing years.

*Gestation Periods.*—The gestation periods reached by the patients in this series show that 51 cases were at term when separation occurred, 34 eight months advanced, 21 seven months, 10 six months, 2 five months, and 1 four months. In nine cases the gestation period was not recorded. Characteristic of those cases in which separation occurred early is the fact that the majority were clinically indistinguishable from miscarriage until delivery had been effected; this was true of the two five months cases and of seven of the ten at six months. One case occurring at six months presented an unduly hard uterus, while the two others could not be distinguished from placenta previa until this had been ruled out by pelvic examination. The patient who was found to have a separated placenta at four months was operated on for questionable ruptured ectopic pregnancy or ovarian cyst with twisted pedicle, and was found to have a three months fetus with a separated placenta and a pint of clot in the left horn of a bicornuate uterus. The only one of these early cases suggesting ablatio before delivery because of a rigid uterus showed a placenta completely separated which fell out on top of the baby.

*Predominant Sign of Ablatio.*—The most constant symptom and sign of separation in this series was hemorrhage. Frank vaginal bleeding had occurred in 116 of the recorded patients at some time before diag-

nosis and delivery, or in 92.8 per cent. In only nine cases, or 7.2 per cent was the hemorrhage completely concealed. In three records data regarding hemorrhage were lacking.

*Initial Symptom.*—In point of time, hemorrhage was the initial symptom observed in 74 patients, or 59.2 per cent; labor was observed first in 30, or 24 per cent; abdominal pain 11 times, or 8.8 per cent. Hemorrhage coincided with the onset of labor in six patients; hemorrhage with abdominal pain in three; and labor with continuous abdominal pain in one. Here again data as to the initial symptom are lacking in three cases.

*Condition of the Uterus.*—Uterine consistency was recorded as rigid, hard, tense, contracted, or firmer than normal in 34 cases, or 29.3 per cent; as boardlike in 8, or 6.8 per cent; as not relaxing normally in 13, or 11.1 per cent, chiefly in cases in labor when observed. In one case seen early, where the only symptom was abdominal pain without labor or bleeding, the uterus was found to show no abnormality other than marked tenderness and slight irregularity over a circumscribed area on its left side. In 11 cases the consistency of the uterus could not be determined from the records. The remainder, 61 in number, or 52 per cent, either were definitely described as soft and nonresistant, or did not deviate sufficiently from the normal to be deemed worthy of note; of these 38 were examined by vagina in order to rule out placenta previa, among which are the eight cases of low attached placenta mentioned above.

*Etiology.*—The etiology of many cases in this series cannot be determined. Three patients gave histories of possible trauma. One entered the hospital with vaginal bleeding following a long automobile ride. Another had taken a long street-car ride twenty-four hours before admission and had bled subsequent thereto. The third struck her abdomen on the side of her bed at 6:30 P.M., following which the abdomen enlarged and became tender; cesarean section showed the presence of uteroplacental apoplexy after her admission to the hospital at 10 the same night. The first and last of these three, however, were definitely albuminuric, so that it is a question whether the trauma was not a coincidence rather than the cause of the separation. Two cases showed a premature separation following a sudden decrease in the bulk of the uterine contents: one of them had had her membranes ruptured and a bag inserted for acute hydramnios, and had begun to bleed around the bag five hours after this had been placed in the cervix; the other occurred in the second stage of labor in a primiparous breech delivery, and indicates one source of natal and neonatal deaths in babies born by this mechanism. One case was associated with a uterine fibroid the size of a canteloupe. Finally, one patient had inserted a catheter two days before admission to hospital and had bled

as a result; three days after entrance she was bagged and delivered because of a temperature rise to 100° F. and the persistence of a foul, dark flow.

*Coincidence of Toxemia and Ablatio.*—It is most interesting to note the association of albuminuria, hypertension, or both with many of the cases of this series. Thirty-one, or 24.2 per cent of the patients showed evidence of a definite toxemia by demonstration of hypertension, albuminuria with or without casts in the sediment, or both. Six patients, or 4.7 per cent were eclamptics. The remaining 91 cases, 71 per cent, are regarded as nontoxemic because their records either show definitely that no signs of toxemia were present or are so incomplete that a decision on this point cannot be made. Interpretation of the presence or absence of toxemia in the series is therefore conservative and concedes that certain cases may have had an unrecognized toxemic background. Although the belief is held by many, including Williams and Holmes, that the toxic material involved in placental separation differs from that responsible for the occurrence of "preeclamptic toxemia," and although many ablatios are definitely of nontoxemic background, the present series affords 11 instances of patients who were known to have a definite toxemia and who were being "carried along" on a dietary and eliminative régime, in whom a separation of the placenta occurred. The question as to cause and effect cannot, of course, be finally decided until more accuracy has been attained in differentiating the various toxemic states than our present knowledge of them affords, and until the nature of the toxic substance or substances has been determined.

If one is to believe that a toxemic state bears some etiologic relationship to ablatio placentae it would be interesting to know what the likelihood is that a toxic patient will develop this complication. The hospital records for the same eleven years yield a total of 612 deliveries of toxemic cases, of 95 eclamptics either delivered in the hospital or dying undelivered, and of 67 chronic nephritics not classified under the two previous headings. Here again controversy may be raised as to the relationship or nonrelationship of these three alleged entities each to the other: the fact remains, however, that they show sufficient clinical relationship to make it reasonable to classify them together for this purpose. Add to these 15 cases of the 128 ablatios which, though not recorded as toxemias, prove on close examination to have had a toxemic background, plus one which escaped the classification of convulsive toxemia, and we have 790 cases in which a total of 37 ablatios occurred. This constitutes one premature separation of the placenta in twenty-two deliveries of toxemias, a ratio which suggests more than a casual relationship between the two conditions.

*Methods of Delivery.*—Delivery of the patients in this series was effected through the pelvis in 89 cases, or 69.5 per cent. Seventeen of



these were delivered spontaneously, five by forceps, five by version or breech extraction, three by vaginal hysterotomy, three by Braxton-Hicks bipolar version; manual dilatation was resorted to 21 times, and the Voorhees bag was used in 35 cases, four of which required subsequent manual dilatation. Abdominal cesarean section accounted for 39, or 30.5 per cent of the deliveries, including one in which hysterectomy was done when the uterus was found to be badly infiltrated and noncontractile.

*Uteroplacental Apoplexy*, as distinct from simple separation, was identified in 12 cases of the series, one case being undetermined. Since diagnosis of toxemic apoplexy is purely conjectural if the abdomen is not opened, diagnosis in these twelve cases was based on findings at cesarean, and only those cases are recorded as apoplexy where hemorrhagic infiltration of the uterine wall was definitely observed. Nine of the twelve patients were toxemic, and one eclamptic. In one of the remaining cases there was a trace of albumin in the urine on admission, but as the patient had been flowing and as the specimen was not recorded as having been obtained by catheter, the fact that blood was found in the sediment points to the probability of contamination. Her blood pressure was 120/90 on admission and remained between 118 and 134 throughout convalescence, while catheter urine shortly after delivery was albumin free. The other patient showed no rise in blood pressure above normal, while the only specimen of urine examined following postoperative catheterization showed a S.P.T. of albumin with pus in the sediment. It seems fair to exclude these last two cases from the toxemic classification.

Table II indicates that in all the patients who showed the apoplectic type of separation the uterus was rigid, boardlike, or not relaxing normally. This observation, so far as it goes, supports the hypothesis that undue hardness of the uterus may be indicative of an underlying apoplexy, especially when, as happened in ten of the twelve apoplectics the uterine rigidity was associated with evidence of a toxemia. Unfortunately for this idea, however, Table III shows a series of ten patients with toxemic backgrounds and rigid uteri in whom cesareans were done without disclosing manifestations of apoplectic changes. In other words this series does not bear out the above hypothesis.

The fact, however, that the term "uteroplacental apoplexy" suggests a fulminant onset of the condition lends interest to the initial symptom in these cases. Pain was the initial symptom in five of eleven of the apoplectic patients in Table II, five others starting proceedings with bleeding and one with labor. This is in marked contrast to the initial symptoms in Table III, where cesarean failed to disclose apoplexy, for in these 25 cases pain was initial in only two.

It must be admitted, then, that the present series yields no sign or combination of symptoms and signs by means of which the presence of

the apoplectic type of placental separation can be diagnosed before delivery. Elevation of the blood pressure does not aid materially in settling the question as it is much influenced by shock, hemorrhage, or both, and was recorded as 140 or higher in only four of the twelve proved cases of apoplexy.

*Degree of Placental Separation.*—This could be ascertained in only 90 of the histories. In 35, or 39 per cent, separation was complete; in 55, or 61 per cent it was partial. It is interesting to note that in two cases delivered following bag induction of labor, no anatomic evidence of separation was found. In the apoplectic series detachment was complete in seven, incomplete in two, not recorded in three, making

TABLE II. UTEROPLACENTAL APOPLEXY

CASE NUMBER	TOXEMIC	ONSET	UTERUS	B.P.	DETACHMENT PLACENTA	RESULT L. OR D.
28220	No	Pain	Rigid	120-134	Not rec.	L.
28595	Yes	Pain	Rigid	125	Not rec.	L.
28938	Yes	Hem.	Boardlike	116	Complete	L.
29384	Yes	Hem.	Rigid	140	Complete	D.
29779	Eclamptic	Hem.	Rigid	160	Complete	D.
29980	Yes	Hem.	Rigid	140	Complete	D.
30905	Yes	Labor	Not relaxing	130	Partial	L.
32135	No	Hem.	Boardlike	88	Not rec.	L.
32158	Yes	Pain	Rigid	140	Complete	L.
32344	Yes	Pain	Rigid	100	Complete	L.
33399	Yes	Pain	Boardlike	130	Partial	L.
35714	Yes	Not rec.	Rigid	82	Complete	L.

TABLE III. CESAREAN DELIVERIES. APOPLEXY NOT DEMONSTRATED.

CASE NUMBER	TOXEMIC	ONSET	UTERUS	B.P.	DETACHMENT PLACENTA	RESULT L. OR D.
25065	No	Hem.	Rigid	Not rec.	Complete	L.
26035	No	Labor	Rigid	120	Partial	L.
26240	No	Hem.	Rigid	60	Partial	D.
27477	Yes	Hem.	Rigid	120	Partial	L.
27521	Yes	Hem.	Rigid	60	Complete	L.
27524	Yes	Hem.	Rigid	145	Complete	L.
27571	No	Hem.	Not relaxing	110	Complete	L.
28036	No	Hem.	Not rec.	120	Complete	L.
28141	No	Labor	Not relaxing	110	Partial	L.
28855	No	Hem.	Relaxed	120	Partial	L.
29194	No	Labor and hem.	Not relaxing	105	Partial	L.
29863	Yes	Hem.	Not rec.	190	Not rec.	L.
30665	No	Hem.	Relaxed	130	Not rec.	L.
32040	No	Not rec.	Not rec.	132	Complete	L.
32076	Yes	Hem.	Not relaxing	140	Partial	D.
32500	No	Pain	Tender L. side	120	Partial	L.
32797	No	Labor and hem.	Not rec.	106	Not rec.	L.
33401	Eclamptic	Hem.	Rigid	228	Partial	D.
33523	Yes	Hem.	Rigid	160	Partial	L.
34304	No	Labor	Not rec.	108	Partial	L.
34308	Yes	Pain	Rigid	128	Complete	L.
35013	No	Labor	Relaxed	128	Partial	L.
35060	Yes	Hem.	Not relaxing	190	Partial	L.
35440	No	Hem.	Boardlike	80	Complete	L.
35815	Yes	Not rec.	Rigid	110	Not rec.	L.
36124	No	Hem.	Relaxed	118	Not rec.	L.
36504	Yes	Hem.	Rigid	120	Not rec.	L.

the incidence of completely detached placentas definitely higher in this class than in the series as a whole.

*Fetal and Neonatal Mortality* was found to be high. Fifty living babies were born and survived, a percentage of 38.5, while 80 babies stillborn and dying shortly after birth (including two pairs of twins) indicate a mortality of 61.5 per cent.

*Maternal Mortality.*—(Table IV). Eleven mothers died, 117 survived, a mortality of 8.6 per cent. Of these, four died from shock and hemorrhage shortly after delivery; one, a toxemic, following Braxton-Hicks version, two, with toxemic data unrecorded, following accouchement forcé, one, presumably nontoxemic, following cesarean section. One patient, with no evidence of toxemia, also died of shock and hemorrhage following accouchement forcé. One toxemic patient, delivered by cesarean, died six days postpartum with complete suppression of urine. One eclamptic delivered by cesarean plus hysterectomy, also died six days postpartum with uremic symptoms and a possible terminal pneumonia at a time when urinary secretion was beginning to be reestablished following practically complete suppression. Another toxemic patient died in collapse some six hours after delivery by cesarean. One toxemic, delivered by cesarean, died eight days postpartum of uterine sepsis, pelvic peritonitis, and bronchopneumonia. One eclamptic, in whom labor was induced with the Voorhees bag, died nineteen hours postpartum with the clinical diagnosis of acute dilatation of the heart, which, however, was not demonstrated at necropsy. One eclamptic died four hours postpartum following cesarean section.

The series of uteroplacental apoplexies shows three deaths, a mortality of 25 per cent. The 27 cesareans in whom apoplexy was not demonstrated resulted in three deaths, a mortality of 11.1 per cent.

*Postmortem Findings.*—Formal necropsy was obtainable only in three cases. Only the second of these showed a uterus which was grossly hemorrhagic, and which proved the case in retrospect to have belonged in the apoplectic group. The third case showed a liver which revealed eclamptic changes on microscopic examination, but the uterus was recorded as not remarkable either grossly or on histologic section. In one case, however, where permission for necropsy was refused, the abdomen was reopened postmortem through the cesarean incision, and portions of the liver, kidney, and uterus were removed for microscopic examination; these showed, respectively, acute hemorrhagic necrotizing hepatitis confined chiefly to the periportal areas, acute diffuse nephritis, and hemorrhages into the uterine musculature. This case is of especial interest in that it shows the presence of an "eclamptic liver" in a patient who had had no convulsions but who had a typical uteroplacental apoplexy in the presence of a toxemia

TABLE IV. DEATHS

CASE NO.	TOXEMIC	ONSET	UTERUS	APOPLEXY	DELIVERY	DATE DEL.	DEATH
22377	Yes	Labor	Rigid	?	Brx. Hicks	4/ 8/16	1/2 hour postpartum, shock and hemorrhage.
24585	No	Hem. & pain	Relaxed	?	Acc. Forcé	5/15/18	5 hours postpartum, shock and hemorrhage.
25368	No	Labor	Relaxed	?	Acc. Forcé	1/19/19	2 1/2 hours postpartum, shock and hemorrhage.
26240	No	Hem.	Rigid	No	Cesarean	11/21/19	4 hours postpartum, shock and hemorrhage.
28724	No	Labor	Rigid	?	Acc. Forcé	2/14/22	3 hours postpartum, shock and hemorrhage.
29384	Yes	Hem.	Rigid	Yes	Cesarean	10/29/22	6 days postpartum with complete suppression of urine.
29779	Eclamptic	Hem.	Rigid	Yes	Cesarean	3/21/23	6 days postpartum with uremic symptoms following period of suppression of urine.
29980	Yes	Hem.	Rigid	Yes	Cesarean	5/11/23	Collapse 6 hours postpartum.
32076	Yes	Hem.	Not relaxing	No	Cesarean	9/ 5/24	8 days postpartum of sepsis.
32384	Eclamptic	Hem.	Rigid	Yes, necropsy	Bag	11/15/24	19 hours postpartum of acute dilatation of heart.
33401	Eclamptic	Hem.	Rigid	No	Cesarean	5/27/25	4 hours postpartum, in convulsion.

which was diagnosed clinically as of the chronic nephritic type. It suggests, in this one case, at least, that the hepatic change incident to toxemic apoplexy may conform to the common picture of the characteristic alterations produced by the toxin of eclampsia.

#### CONCLUSIONS

1. Premature separation of the placenta occurred once in every ninety-four deliveries at the Boston Lying-In Hospital during the eleven years, 1916 to 1926, inclusive. The fact that it occurred in 39 primigravid patients as compared with 89 multigravidas makes it probable that its incidence is at least as common as a complication of primiparous pregnancies and labors as of multiparous. The incidence was slightly more frequent below the age of thirty years than at this age and above. It may occur at any time after the placenta is fully formed, but before the seventh month the symptoms and signs are usually indistinguishable from those of miscarriage.

2. Vaginal bleeding is the most constant symptom as well as sign of this condition, and occurs first in point of time more often than not. External bleeding is not, however, necessary to clinch the diagnosis in many cases, and its occurrence should not be awaited in the patient where other indications point to the presence of an ablatio.

3. None of the cases in which the hemorrhage was of the completely concealed type resulted fatally for the mother.

4. Uteroplacental apoplexy can be identified only at cesarean section or by necropsy. No sign, or combination of signs, yet described enables us to diagnosticate this type of separation with any degree of accuracy.

5. Twenty-four and two-tenths per cent of the cases in this series showed a toxemic background, 4.7 per cent were in eclamptics. Ablatio occurred once for every twenty-two cases with toxemia delivered during the eleven years. The occurrence of separation being four times more frequent in toxemics than in the general series of deliveries points strongly to a toxic element in this type of case which may bear a causative relation to ablatio. The nature of the toxic substance or substances is still undetermined.

6. The maternal mortality in this series was 8.6 per cent, fetal and neonatal 61.5 per cent. More mothers died in cases where uteroplacental apoplexy was present than in those where it was not.

7. The occurrence of suppression of urine following cesarean for ablatio in toxemic cases is a complication of the gravest prognosis. Two such cases reported in this series resulted fatally.

# A REPORT OF CASES OF CARCINOMA OF THE CERVIX TREATED BETWEEN 1875 AND 1927 AT THE BOSTON FREE HOSPITAL FOR WOMEN

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OF 23,781 patients admitted to this hospital between November, 1875, and January, 1927, 550 were found to have carcinoma of the cervix. In 433 cases the diagnosis was made or confirmed by microscopic examination. The clinical findings in the other 117 were such as to leave no doubt about the diagnosis, and 85 of this group were seen before 1902, when microscopic examination was not a routine procedure.

Forty-four of the 433 showed adeno- and the remainder squamous carcinoma. It has been found impossible to distinguish clinically between these two types either in the diagnosis or in the course of the disease.

Fifty-two patients, 9.4 per cent, gave a history of never having been pregnant. This includes both single and married women.

Twelve patients had had previous trachelorrhaphy for cervical lacerations four to twenty years before the diagnosis of carcinoma; 6 of these were operated upon at this hospital. Thus, of 3650 patients on whom the operation of trachelorrhaphy was performed between October, 1875, and January, 1927, at least 6 later developed carcinoma. Would more or less than 6 of this group have developed carcinoma if the trachelorrhaphies had not been done? We cannot render figures one way or the other. As evidence, however, of the prophylactic and diagnostic value of trachelorrhaphy, we have found in the last eight months (February to October, 1927) early but unmistakable carcinoma microscopically in the trachelorrhaphy specimens of three patients whose lacerated cervixes gave absolutely no gross suggestion of the disease. This unexpected finding of carcinoma occurs on an average of twice a year, during which period about 130 cervixes are repaired. Further, as purely suggestive evidence for the prophylaxis of cervical carcinoma, not one of this series of 550 cases gave a history of cauterization of the cervix and of the 1150 patients who had cauterization of the cervix between 1914 and January, 1927, not one has been known to develop carcinoma.

Nineteen patients had had previous supravaginal hysterectomy. From a careful study of this group it was determined that 10 quite certainly could not have had carcinoma of the cervix at the time of hysterectomy, that 5 quite certainly did have cervical carcinoma at

the time of hysterectomy and that 4 might or might not have had the disease. Ten of the 19 had had their previous supravaginal hysterectomies at this hospital and two of these probably had carcinoma of the cervix at the time of hysterectomy. During this same 51+ year period 2400 supravaginal hysterectomies were performed. We know of 8 who later developed carcinoma of the remaining cervix, an incidence of at least 0.0033 per cent.

Fifty-nine, or 10.7 per cent, gave a family history of malignant disease.

The two youngest patients in this series were twenty-five years of age.

There were 40 patients who received no operative treatment, either being beyond any palliative procedure when seen or refusing operation.

#### OPERATIVE MORTALITY

There were 24 postoperative deaths out of 510 patients operated upon, a gross mortality of 4.7 per cent. Nineteen deaths followed abdominal operation, 4 followed curettage and cauterization and 1 radical amputation of the cervix. Nine of the 19 deaths following abdominal operation occurred before 1902 making the operative mortality before this date 64.2 per cent. Of the other 10 operative deaths, which occurred after 1902, one followed radical abdominal excision of the cervical stump (3 in all), a mortality of 33.3 per cent, 5 followed complete abdominal hysterectomy (50 in all), a mortality of 10.6 per cent and 4 followed the Wertheim operation (81 in all), a mortality of 4.93 per cent. Of a total of 140 abdominal operations performed between 1902 and 1927 on patients with carcinoma of the cervix there were 10 operative deaths, a mortality of 7.14 per cent.

#### OPERATIVE TREATMENT

One hundred and twenty-one patients were treated by curette and cautery only. The majority of these were inoperable and were seen before radium and x-rays were available.

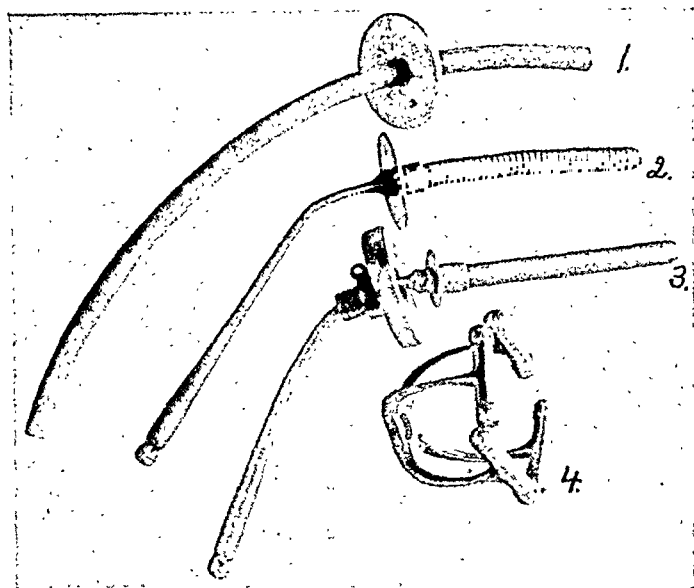
Amputation of the cervix was performed on 28 patients. Nearly all of these were seen when abdominal operations were feared and avoided. It is of interest to state in parenthesis that of the only 3 cases of malignant pelvic disease in 638 patients with procidentia seen during the same period, one was a carcinoma of the protruding cervix, and in this instance amputation was the only possible method of operation because the disease had grown up over the bladder.

Palliative supravaginal hysterectomy was performed on two advanced cases.

Vaginal hysterectomy was done on 13 patients, all before 1900.

Three radical abdominal excisions of cervical stump carcinoma were performed on patients who had had previous supravaginal hysterectomy.

Under the heading of complete hysterectomy are classed those patients on whom radical operation was performed without dissection and isolation of the ureters, this as distinguished from the Wertheim method where a wider excision is made possible by isolation and lateral displacement of the ureters. Forty-three patients were treated by complete hysterectomy alone, 58 by the Wertheim hysterectomy alone. Eighteen patients were treated by Wertheim hysterectomy followed by radium, 14 by complete hysterectomy followed by radium and three by supravaginal hysterectomy followed by radium. Radium followed by Wertheim hysterectomy was the procedure with five patients, radium then complete hysterectomy with four, radium then radical excision of cervix with two and radium followed by supravaginal hysterectomy with two.



Figs. 1, 2, 3, and 4.

Fig. 1.—Coin and tube applicator (described in text).

Fig. 2.—Flexible tube applicator. The tube is made by winding flat, 0.5 mm. thick, brass wire and silver, soldering it to a threaded base which fits a flexible copper handle. The brass washer butts against the cervix and serves to prevent displacement when the vagina has been packed with gauze. (The various tubes, handles, washers and pill boxes are all standardized and interchangeable so that a number of combinations can be put together.)

Fig. 3.—Brass tube and pill box applicator, as described in the text. The tube, attached to the handle with a small washer intervening, is first inserted into the cervical canal. Then the pill box is slipped down over the tube. The gauze packing holds the box against the cervix or vaginal vault.

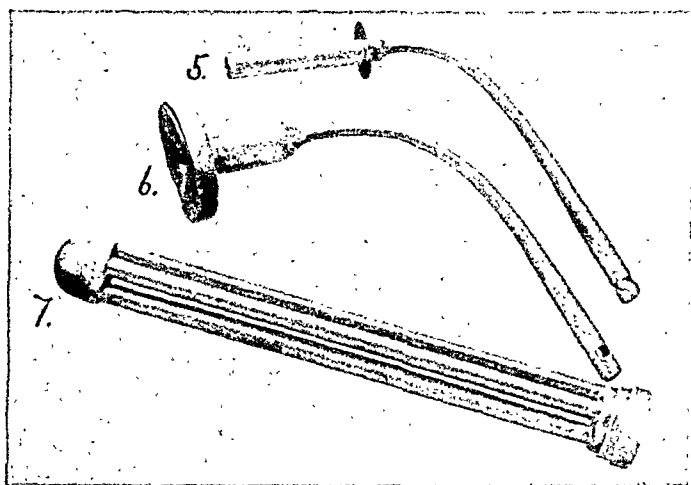
Fig. 4.—Pinwheel applicator, for getting the radium nearer the vaginal fornices. Each arm will hold a 25 mg. capsule. In certain cases this apparatus can be used with the tube and handle in place of the pill box.

#### RADIUM TREATMENT

Radium alone was used for 193 patients by the application of the radium salt, the bromide, in glass capsules surrounded by 0.5 mm. silver capsules. The dosage has varied from 100 to 225 mg. for from two to thirty-six hours, most generally 200 or 225 mg. for twenty-four hours. Doses of more than 100 mg. have not been left in for more



than twenty-seven hours. One method of application has been as follows: two 50 mg. capsules in a rubber tube are inserted in the cervical canal and uterine cavity and 125 mg., plastered to a 50-cent piece or a silver dollar (with holes bored in their centers for the passage of the rubber tube) and covered by a rubber dam, are applied against the diseased cervix, the surrounding parts being packed away by gauze strips (see Fig. 1). Where indicated, a curettage and cauterization to remove excess growth and allow for better application has been performed from ten days to two weeks before the radium was used. That this procedure is fraught with no apparently unfavorable effects is shown by a comparison of end-results. Half of those patients who had operation or radium had preliminary curettage or curettage and cauterization; half did not. No difference in results could be detected. Similarly, of the 24 patients who lived longest



Figs. 5, 6, and 7.

Fig. 5.—Handle, washer and short brass tube.

Fig. 6.—Pill box and handle, for use in applying radium after a complete hysterectomy or in any instance where the tube is not practicable.

Fig. 7.—Rectal radium applicator, can be used in carcinoma of the rectum, where carcinoma of the cervix has involved the rectum and in carcinoma of the vagina. The apparatus consists of five brass tubes, 0.5 mm. thick, fastened to a base at each end. The bullet end of the applicator and the cap are threaded to fit these bases. Each tube is numbered. By using pieces of thin, wooden swab sticks as plugs, the radium capsules can be distributed as desired and held in place.

after treatment, 13 had preliminary curettage or curettage and cauterization and 11 had no manipulation beyond careful bimanual examination.

Another and more recent method of application has been by 0.5 mm. brass containers (Figs. 2, 3, 5, and 6). One hundred mg. are placed in the brass tube, stiff or flexible, in the cervical canal and 125 mg. are laid in modelling wax in the brass pill box, \$1.00 or 50 cent size, covered with a 0.5 mm. brass lid and butted against the disease. The brass eliminates practically all the beta rays that get by the silver capsule. No attempt has been made to eliminate secondary beta rays.

Another method for getting the radium nearer the parametria and into the vaginal fornices has been used occasionally in the past two years (Fig. 4).

### RESULTS

We have no follow-up data on 156 patients after their discharge. The majority of these were treated in the earlier days of the hospital. (These cases are included in our calculations.)

The following is a summary of results as determined by follow-up to January 1, 1927:

#### GROSS STATISTICS

Received no treatment .....	40
Not traceable .....	156
Operative deaths .....	24
Died 6 months or less after discharge .....	72
Died 6 months to 1 year after discharge .....	71
Died 1 to 2 years after discharge .....	59
Died 2 to 3 years after discharge .....	20
Died 3 to 4 years after discharge .....	5
Died 4 to 5 years after discharge .....	7
Died 5 to 10 years after discharge .....	4
Died over 10 years after discharge .....	1
Living 6 months or less after discharge (recent cases) .....	13
Living 6 months to 1 year after discharge .....	23
Living 1 to 2 years after discharge .....	31
Living 2 to 3 years after discharge .....	22
Living 3 to 4 years after discharge .....	8
Living 4 to 5 years after discharge .....	6
Living 5 to 10 years after discharge .....	15
Living over 10 years after discharge .....	10

Thus, of 510 patients in all who were treated, 10.98 per cent passed the three-year interval and 5.88 per cent passed the five-year interval. Taking into consideration the fact that some of these patients died of late recurrence after passing the five-year interval (we know of five such) and that probably some of the 156 who were not traceable did pass the five-year interval, 5 per cent of absolute cures in this series is approximately correct.

For comparing results, the patients are grouped according to the classification of the American College of Surgeons:

- A. Disease limited to cervix.
  - B. Disease involving cavity or vaginal wall.
  - C. Disease involving broad ligaments.
  - D. Wide fixation. Remote metastases.
1. Primary case.
  2. Recurrence in vaginal wall following panhysterectomy for cancer.
  3. Recurrence deep in pelvis following panhysterectomy.
  4. Carcinoma of cervix following supracervical hysterectomy.

## DETAILED STATISTICS BY CLASSES

*Class A.*—Of the four patients who received no treatment, two refused operation and two failed to return when summoned, the disease having been discovered on microscopic examination of the tissue removed at a repair operation. Three of these are untraceable. The other died one year after discharge.

Of the three patients treated by curette and cautery, one died six months P.O., one died at one year three months P.O., and one was alive when last seen, one year three months P.O.

Two patients were treated by amputation of the cervix; one was alive and well twenty-two years P.O. and one is now alive and well, seven months P.O. (Procidencia with carcinoma of cervix.)

Vaginal hysterectomy was performed on two cases; one was an operative death—the other was alive and well eleven years five months P.O.

Fifteen patients were treated by complete hysterectomy. There was one operative death; one is untraceable, one died one month P.O., one died at one year two months P.O., one at three years eleven months and one at five years and two months P.O. Three were alive and well from one year to one year six months P.O. One was alive and well at four years ten months P.O., one at five years seven months, one at six years six months, one at ten years, one at sixteen years and one at seventeen years P.O. Passed the three year interval—53.3 per cent; the five year interval—40 per cent.

The Wertheim operation was the procedure with 28 patients. There were no operative deaths. Two could not be traced after leaving the hospital. One patient died eight months P.O., one died of heart disease two years four months P.O., one died of cancer at two years eleven months, one at three years nine months, one at four years nine months, and one at five years ten months. Four recent cases are alive and well less than one year P.O. Two other patients were well at three and five months P.O. but are untraceable further. Two are apparently well at one year two months and one year three months P.O. and three between two and two and one-half years P.O. One was alive and well at four years P.O., one at four years seven months, one at five years five months, one at six years eight months, one at six years ten months, one at 7 years, one at seven years two months, one at nine years and one at fifteen years P.O. Passed the three year interval—42.8 per cent. (Calculating to 1924 instead of 1927—63.1 per cent.) Passed the five year interval—28.5 per cent. (Calculating to 1922 instead of 1927—44.4 per cent.)

Radical hysterectomy (includes both "complete" and Wertheim) followed by radium was the treatment in eight cases. There were no operative deaths. One patient died seven months P.O., one at one year eight months P.O., one at four years five months, one at nine years six months and one at ten years five months P.O. Two were alive and well at two years nine months and three years eleven months P.O., respectively. One was living with a recurrence at three years P.O. Passed the three year interval—75 per cent; the five year interval—25 per cent.

Of the two patients treated by radium followed by radical hysterectomy one died of cancer three years four months P.O. and one was apparently well at two years ten months P.O.

Radium alone was the treatment in eighteen cases. There was no operative mortality. Five are well less than one year six months P.O. (recent cases). Three died less than one year six months P.O. Two were living with a recurrence at two years two months and three years nine months P.O. One was alive and apparently well at two years P.O., one at two years four months, one at four years, one at four years four months, one at four years seven months, one at five years nine months, one at six years six months and one at seven years two months P.O.

The last six patients were treated with the radium salt in glass capsules screened by 0.5 mm. silver and rubber as follows: 212.5 mg. for twelve hours—150 mg. for ten hours—200 mg. for twelve hours—100 mg. for eight hours—100 mg. for twenty-four hours and 100 mg. for twenty-four hours; the longest "cure" being from a single dose of 100 mg. for twenty-four hours. Passed the three-year interval—38.8 per cent. (Calculating to 1924—87.5 per cent.) Passed five-year interval—16.6 per cent. (Calculating to 1922—100 per cent—only three cases.)

*Class B.*—One patient received no treatment—did not return when summoned and is untraceable.

Two patients were treated by curette and cautery. One is untraceable. The other was alive, and apparently well, at three years nine months P.O.

Amputation of the cervix was the procedure with five patients. One is untraceable, one was alive with a recurrence six months P.O., one was apparently well at seven years eleven months P.O., one died at eighteen years nine months P.O. and one was well at twenty-one years nine months P.O. Thus, three of five cases passed the seven year interval.

Of the two patients treated by complete hysterectomy one was living with a recurrence at eleven months and one died at two years P.O.

The Wertheim operation was performed on five patients. One died at seven months, one at one year and one at two years six months P.O. One recent case is alive and well at two months and one at one year P.O.

Radical hysterectomy followed by radium was the procedure with five patients. One died at one year six months, one at two years six months and one at four years four months P.O. Two were alive and well from ten to eleven years P.O.

One patient, treated by radium followed by hysterectomy, was well two years ten months P.O.

Of the fourteen patients receiving radium alone three died less than one year P.O., two less than two years P.O., three are living between one and two years P.O., five are living between two and three years P.O., and one died of cancer four years P.O.

*Class C.*—Twelve patients received no operative treatment. Eight were untraced, one died one month after discharge, one at six months, one at ten, and one at eleven months after discharge.

The curette and cautery only were used on thirty patients. There were two operative deaths; thirteen patients are untraceable. Five died less than one year P.O., two at one year four months and one at two years two months P.O. Three were living with a recurrence less than six months P.O., one at one year, one at one year three months, one at one year ten months and one at four years P.O.

Amputation of the cervix was performed on eighteen patients. There was one operative death. Nine patients could not be traced. One died one month P.O., one at one year four months and at two years P.O. There were alive with recurrence—one at two months P.O., one at five months, one at nine months, and one at one year three months P.O. One patient was apparently well at two years five months P.O.

Eight patients were treated by vaginal hysterectomy. Five were untraceable. One died six months P.O., one was moribund at seven months and one was apparently well at four months P.O.

Complete hysterectomy was performed on twenty-three patients. There were nine operative deaths—39.1 per cent. Two were untraceable. One died three months P.O., one at six months. One died at one year P.O., one at one year two months, one at one year four months, one at one year six months and one at two years one month P.O. Five were alive with a recurrence at five months, six months, one

year three months, one year four months and three years one month P.O., respectively.

Thirteen patients were submitted to the Wertheim operation—with two operative deaths. Eight died—at four months, six months, seven months, nine months, ten months, one year, one year seven months and one year eleven months P. O., respectively. Three were alive with recurrence at ten months, one year two months and one year four months P.O.

Fifteen patients had radical hysterectomy followed by radium, either at once or later. There was no operative mortality. Two died between six months and one year P.O., three died between one and two years P.O., four died between two years six months and three years P.O., one at four years six months and one at eight years eight months P.O., all of cancer. Three were alive with recurrence at two years two months, two years eleven months and six years two months P.O. One recent case is well eight months P.O. These figures as well as the corresponding figures in Classes A and B indicate strongly that radium as a routine procedure following hysterectomy would cause a distinct prolongation of life.

Radium first, then hysterectomy, was the order with eight patients. There was one operative death. One patient is untraced. The other six patients died as follows: at eleven months P.O., at one year one month, at one year five months, at two years five months, at two years six months and at six years eleven months after radium application—all of carcinoma.

Ninety-five patients were treated with radium alone. No operative mortality. Seven could not be traced following discharge. Ten died less than six months after treatment, twenty-five from six months to one year, twenty-three from one year to one year six months, two from one year six months to two years, three from two years six months to three years and one at four years after treatment. There were living with recurrence less than one year P.O.—eight patients; between one and two years—six; at two years seven months—one; at two years eight months—one. There were apparently well—two at six months—one at seven months—one at one year six months—one at two years two months—one at two years seven months—one at three years seven months—and one at four years three months after treatment.

*Class D.*—Thirteen received no operative treatment. Eight were untraced; the other five died six months or less after they were seen.

Curettage and cauterization was the only treatment in eighty-one cases. There were two operative deaths. Forty-six had no follow-up. Eighteen patients died less than six months P.O., eight from six months to one year, three from one to two years and one at three years P.O. Nine were alive from two months to one year and two from one year to one year six months.

Cervical amputation was performed on three patients. One died six months P.O., one at eleven months and one at one year six months, P.O.

Vaginal hysterectomy—three cases. One was an operative death, one was untraced and one died seven and five-tenths months P.O.

The Wertheim operation was the procedure with twelve patients. There was one operative death. One is untraced. Three died between five and eleven months P.O., one at two years and one at four years eleven months P.O. Four were alive with recurrence less than 8 months P.O. One patient was well at ten years ten months P.O. (Had large iliac gland metastases at time of operation.)

One patient died eight months after complete hysterectomy.

Seven patients had hysterectomy and radium. One is untraced. Two were alive with a recurrence at four and eight months P.O. The other four died less than one year eight months P.O.

Radium followed by hysterectomy—two cases—died at five and eleven months P.O.

Radium alone was used in sixty-one Class D cases. Untraced—three. Died less than six months P.O.—eighteen; six months to one year—thirteen; one year to one year six months—ten; one year six months to two years—two; two years to two years six months—two; one at two years seven months and one at three years P.O. Eleven patients were alive with a recurrence less than one year four months P.O.

#### CLINICAL-PATHOLOGIC STUDY

The following is a résumé of an exhaustive clinical and pathologic study (made by Dr. Smithwick) of 95 cases treated at the hospital between January, 1917, and January, 1925, the purpose being to show that the pathology of cervical carcinomata affords a valuable index

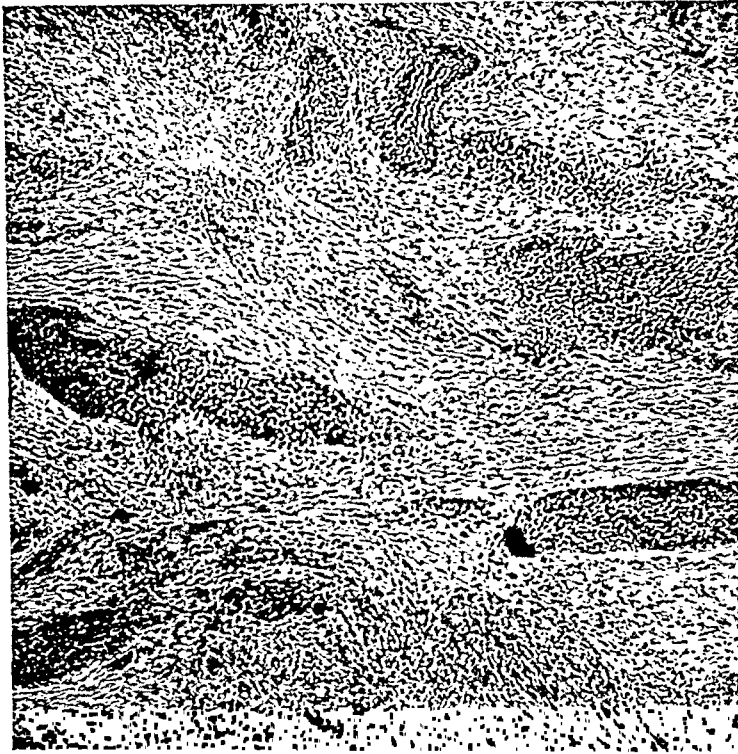


Fig. 8.—A scirrhus carcinoma of the cervix—pure transitional cell type.

as to the choice of treatment of cases in which either operative procedures or radium therapy can be employed.

In addition to the adenocarcinomas, and the “spinal,” “transitional” and “fat spindle” cell types of squamous carcinoma (Martzloff), two other pathologic types have been emphasized, viz., the “scirrhus” (Figs. 8 and 9), in which the stroma or fibromuscular cervical tissue makes up one-third or more of the tumor, and the “soft” (Fig. 10), in which carcinoma cells make up two-thirds or more of the tissue. Any type of cell may predominate in either the scirrhus or soft tumors. The distribution of types in this series is shown in the following table:

TYPES	NO. CASES	% TOTAL	% TOTAL—MARTZLOFF <sup>1</sup> (387 CASES)
Spinal	25	26.4	15.
Transitional	58	61.0	66.8
Fat Spindle	6	6.3	12.0
Adenocarcinoma	6	6.3	5.4
Scirrhou	33	34.8	
Soft	62	65.2	

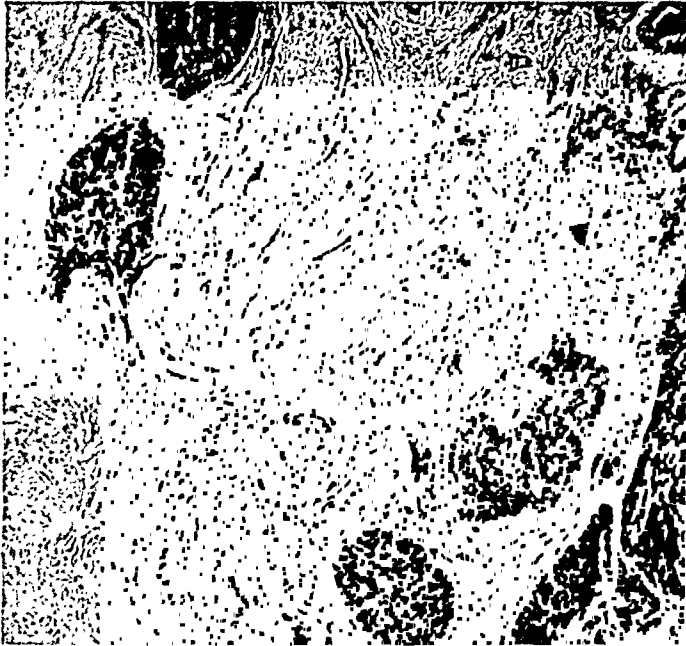


Fig. 9.—A scirrhou type of carcinoma of the cervix in which transitional cells predominate. There are also a few spinal and fat spindle cells.

The following table of cases treated with radium compares the clinical follow-up with the cell type:

TYPE	NO. CASES	AVERAGE RECURRENCE INTERVAL	AVERAGE DEATH INTERVAL
Scirrhou	10	10.5 mo.	
Scirrhou	14		19.6 mo.
Soft	24	3.6 mo.	
Soft	31		9.8 mo.
Spinal	8	3.9 mo.	
Spinal	12		12.2 mo.
Transitional	22	6.1 mo.	
Transitional	29		13.6 mo.
Fat Spindle	2	3.5 mo.	
Adenocarcinoma	2	9.5 mo.	
Adenocarcinoma	3		12.7 mo.

This demonstrates the interesting and important finding that the interval between the application of radium and the first sign of local recurrence was about three times as long in the scirrhou as in the soft carcinomas and that the total duration of life after radium treatment was twice as long in the scirrhou as in the soft tumors. It also

shows that the average recurrences and death intervals were approximately the same regardless of whether the tumor was an adenocarcinoma or the predominating cell type spinal, transitional or fat spindle. Thus it is not the actual type of cell but the proportion of stroma which indicates the prognosis to be expected when radium is used. On the other hand, when not more than one-third of the cervix was involved by the disease, there was found to be no relation between the pathologic type, the intensity of treatment and the result, i.e., 7 out of 8 early Class A cases have passed an average postradium interval of forty-two months to date; they showed all pathologic varieties and their radium dosage varied from 100 mg. for eight hours to 225 mg. for twenty-four hours. The same result could probably have

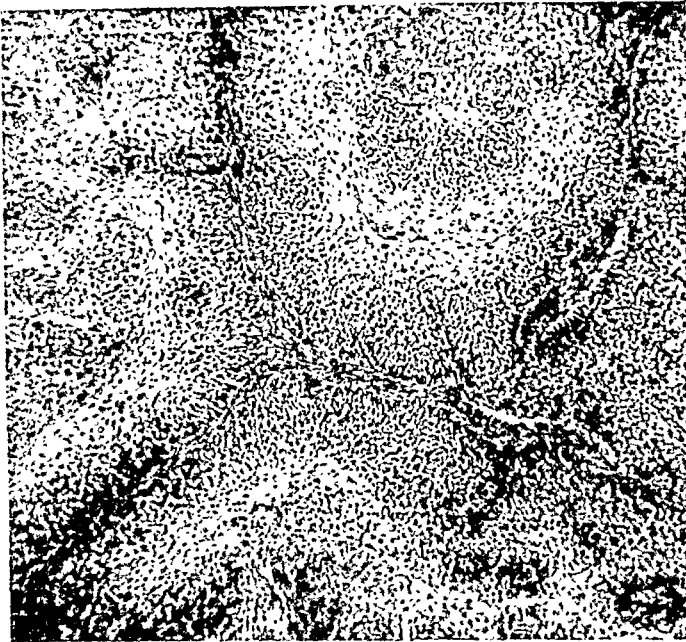


Fig. 10.—A soft type of carcinoma of the cervix. The tissue is nearly 100 per cent tumor cells, the spinal cell type predominating.

been achieved by operation except for the mortality risk which throws the balance in favor of radium in the very early case. In this connection Martzloff<sup>1</sup> has shown that where more than one-third of the cervix is involved the broad ligaments are invaded in 53.6 per cent of cases. This finding was supported by a pre- and postoperative study of a group at this clinic. Thirty-three cases were classed as IA before operation. Following operation it was found necessary to reclassify 12 cases because of broad ligament extension, iliac gland metastasis or both. Eight of these 12 had complained of pain or distress in one or both lower quadrants since the onset of flowing or discharge and in each instance invasion of one or both broad ligaments was found at operation. A history of pain in the sacroiliac



region, sometimes radiating along the course of the sciatic nerve, was obtained in three theoretically IA cases in which metastases to the iliac glands on the side of the pain were demonstrated.

#### SUMMARY AND CONCLUSIONS

1. Of 23,781 patients admitted to the Free Hospital for Women over a period of fifty-one years 550 or 2.31 per cent had carcinoma of the cervix.

2. During this same period 101 cases of carcinoma of the body of the uterus were seen. They comprised 0.42 per cent of the total admissions. The ratio of fundus to cervical carcinomas is thus 1 to 4.46.

3. A history of never having been pregnant was given by 52 or 9.4 per cent of patients with carcinoma of the cervix.

4. A family history of malignancy was given in 10.7 per cent of cases.

5. In patients whose cervixes protrude from the vulva, malignant pelvic disease is rare and carcinoma of the cervix very rare, despite mechanical irritation and a condition of leucoplakia.

6. In recent years the finding of carcinoma of the cervix on routine microscopic examination of the trachelorrhaphy specimens in 1.5 to 2.5 per cent of cases who have cervical repair, indicates that the procedure of trachelorrhaphy and biopsy has very definite value in revealing early carcinomata.

7. It is impossible to show that trachelorrhaphy has an actual prophylactic value as regards carcinoma, although only 6 of 3650 patients who underwent cervical repair are known to have developed carcinoma later, whereas 486 out of 498 cases of carcinoma of the cervix (excluding those who were never pregnant) had had no cervical repair. Furthermore, none of the entire series, 550, had ever had cauterization of the cervix, whereas of 1150 patients who did have cauterization not one is known to have developed carcinoma.

8. Eight of 2400 patients who had had supravaginal hysterectomy performed are known to have developed carcinoma of the cervical stump, an incidence of at least 0.0033 per cent.

9. The fact that carcinomata of the cervix have been entirely overlooked at the time of abdominal operation indicates that careful examination of every cervix, often with biopsy, should be a routine procedure in the operating room.

10. The technic of radium application has been described and illustrated.

11. It could not be shown that curettage or curettage and cauterization affects the outcome in any case any more than do the manipulations of bimanual examination or the ordinary activities of the patient, 13 of the 24 patients who lived longest after treatment having undergone these procedures.

12. The gross operative mortality in this series was 4.7 per cent. The mortality from abdominal operation before 1902 was 64.2 per cent, between 1902 and 1927, 7.14 per cent. In Classes A and B the mortality from radical hysterectomy was 1.51 per cent; in Classes C and D it was 16.04 per cent. No deaths could be attributed to the use of radium.

13. An absolute curability of 5 per cent is approximately correct for this whole group—1875 to 1927.

14. Detailed follow-up statistics have been included. Unfortunately we have no further data on many patients who were apparently well two to three years after operation.

15. Class A cases constituted only 14.9 per cent of the 550 patients with the disease.

16. Of the Class A cases submitted to complete hysterectomy (as distinguished from the Wertheim operation) 53.3 per cent passed the three-year interval and 40 per cent the five-year interval; of those submitted to the Wertheim operation 63.1 per cent passed the three-year interval and 44.4 per cent the five-year interval. Of the 9 Class A patients treated by radium alone before January, 1924, 7 passed the three-year interval. Three Class A patients treated by radium before January, 1922, are alive and well five to seven years afterward.

17. Class A—operative and radium treatment—35 passed the three-year interval; 21 passed the five-year interval (78 cases in all to January, 1927, received treatment).

Class B—operative and radium treatment—9 passed the three-year interval; 5 passed the five-year interval (34 cases treated to January, 1927).

Class C—operative and radium treatment—8 passed the three-year interval; 3 the five-year interval (210 cases treated to January, 1927).

Class D—operation and radium—3 passed the three-year interval and 1 the five-year interval (178 cases treated to January, 1927).

18. No difference between the adeno- and squamous carcinomata could be demonstrated either in the gross appearances or the clinical course of the disease or the results.

19. Radium was used before operation in 13 cases, after operation in 35 cases. Although these series are too small for making definite conclusions, the results were clearly better in those who received post-operative radium.

The following conclusions were reached after a special clinical-pathologic study of 95 cases:

20. The interval between the application of radium and the first sign of local recurrence was found to be three times as long, and the total duration of life after radium twice as long, in the scirrhus as in

the soft or medullary type of carcinomata. Thus a study of biopsy specimens would seem to offer definite assistance in gauging the prognosis in a given case.

21. The results of operative and radium treatment of operable cases, i.e., Class A and early Class C, are very similar in this group.

22. Although comparing the results of treatment with the cell types suggests that the order of malignancy from low to high is spinal cell squamous, adenocarcinoma, transitional cell and fat spindle cell squamous (this is in agreement with Martzloff and others<sup>3</sup>), the differences are so slight that the division of these tumors on the basis of cell type appears to be of little aid either in prognosis or in deciding between radium and operation.

The writers wish to thank Miss Isabelle C. Manson, Miss D. I. MacCormick and Miss S. Dünzinger for much valuable assistance.

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## PEDUNCULATED CYSTIC ADENOMYOMA OF THE UTERUS OCCLUDING THE VAGINA

### REPORT OF A CASE

BY EDWARD L. SAYLOR, M.D., KANSAS CITY, KANSAS

(From the Pathological Department of the University of Kansas School of Medicine)

ABOUT three decades ago there arose an interest in a peculiar uterine newgrowth made up of fibromyomatous tissue in which there were scattered epithelial acini, similar in structure and action to the glands of the endometrium. Although tumors of this type had been previously recognized, it was in 1896 that von Recklinghausen published his classic monograph<sup>1</sup> in which he ascribed their source to misplaced remnants of the wolffian body. He also added that some cases might be due to a direct extension of the uterine mucosa into the myometrium.

Cullen,<sup>4</sup> contemporaneous with the work of von Recklinghausen, was able in nearly every case, to trace a direct continuity between the glandular structures of these tumors, and the existing endometrium. In his book on *Adenomyoma of the Uterus* he conveniently classifies these uterine growths into the following three groups:

1. Diffuse, with the uterus preserving a relatively normal contour.
2. Subperitoneal or intraligamentary.
3. Submucous.

Cullen's method of origin and his classification are generally accepted at the present time, but there are several other theories that have been advanced by different writers. A few authorities contend that in certain uterine adenomyoma, where no connection can be found with the endometrium, the origin is from misplaced portions of Müller's duct. Others consider the possibility of an embolic or metastatic displacement of endometrial tissue. Halban<sup>6</sup> maintaining that this occurred by way of the lymphatics, while Sampson<sup>11</sup> has just recently demonstrated that endometrial emboli may break into

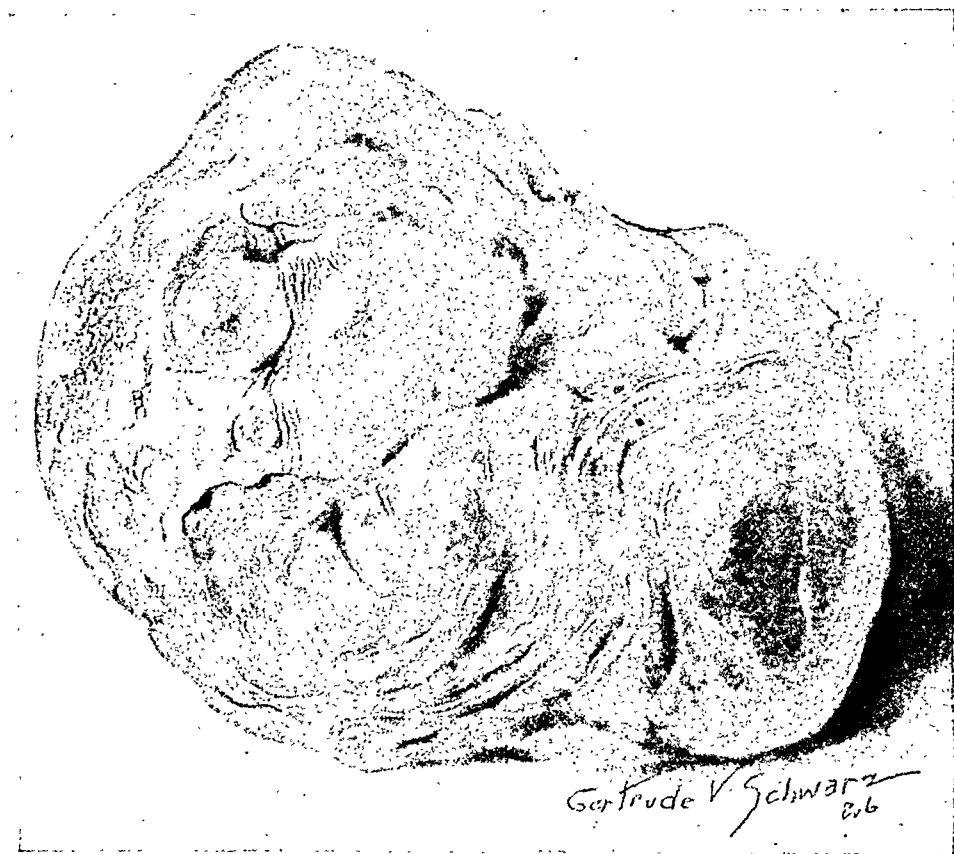


Fig. 1.—Drawing of the tumor showing the cystic appearance.

the blood stream at menstruation, and are disseminated through the veins into the uterine wall, where they can give rise to implantation growths.

This misplaced endometrial tissue is becoming more generally recognized by both clinicians and pathologists, and many endometrial tumors have been discovered in isolated areas unconnected with the ducts of Müller. These ectopic growths occur in such a variety of locations that classification is difficult. An extensive study has been directed to working out their pathogenesis, but has failed to offer an acceptable theory that will explain all cases.

The purpose of this paper is not to delve into the voluminous literature relating to the extrapelvic endometrial growths, but to add to the few cases on record, an unusually large pedunculated adenomyoma of the uterus.

It is known that regardless of whether this aberrant endometrial tissue is intra- or extra-abdominal, there are certain unusual and unexplainable features that typify all these tumors. They occur only in females, more frequently in nulliparas, and are restricted to pelvic and lower abdominal areas. Grossly they usually present a characteristic picture. They are not encapsulated and the outer part has an infiltrating character that gives them a malignant appearance, yet they do not metastasize to distant organs in the manner of true malignancies. If they are of the diffuse uterine type and situated in close proximity to the lumen of the uterus, the endometrial border can usually be seen blending into the myomatous growth. Throughout

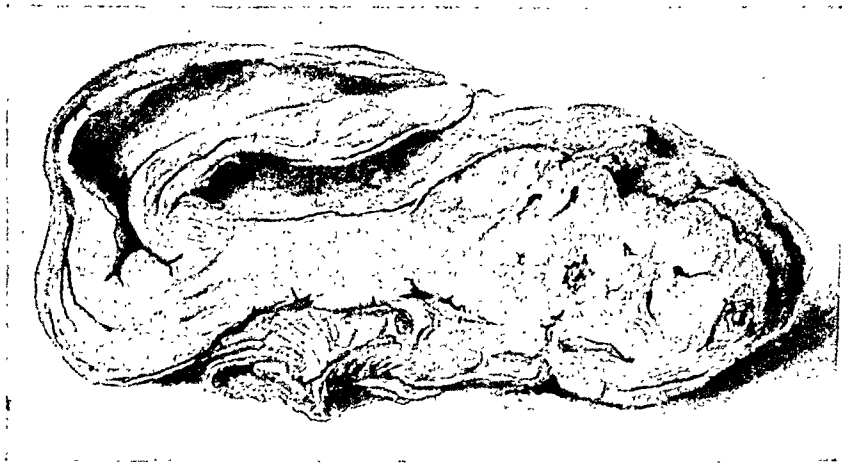


Fig. 2.—Cross-section showing a large cystic cavity within the more fibrous portion of the tumor. On the right are several smaller cleft-like spaces embedded within an area of pale cellular tissue. At the lower border are a few ragged remnants of the pedicle.

the cut section there are many cleft-like spaces scattered among the whorls of fibrous tissue and unstriped muscle. Frequently some of these spaces show cystic dilatation, and may contain hemorrhagic material. The ectopic forms have a similar gross appearance, and can often be recognized macroscopically by the presence of these blood-containing cavities.

Microscopically these tumors consist of variable amounts of interlacing bundles of smooth muscle and fibrous tissue, showing here and there islands of typical endometrial stroma. Irregular gland-like spaces are embedded in this stroma, and are lined with a single layer of more or less columnar epithelium on which cilia can often be demonstrated. Depending upon the size of these spaces they may appear as typical tubules, identical with those of the uterine mucosa, or larger cavities that may either be empty or contain old blood. It is

the hemorrhagic material within these cystic structures that lends unusual interest to these tumors. The presence of this blood, and the fact that these growths sometimes swell and grow painful at menstruation suggest that both are similarly reactive to ovarian stimulation.

It is quite obvious, from the histologic structure, the method of development, and the physiologic action of these tumors that they should have been called adenomyomata, and this is the commonly accepted term in use, especially for the type limited to the uterus.

Since the advent of the work on the heterotopic endometrial tumors many attempts have been made to find an acceptable name that could be applied to any or all of these tumors. Blair-Bell<sup>2</sup> offers the term "endometrioma," saying that it definitely specifies the functional endometrium that is invariably found in these tumors. Nicholson,<sup>8</sup> who



Fig. 3.—Low power photomicrograph (60 diameters) showing the fibromyomatous tissue containing well outlined islands of cellular endometrial stroma. Typical uterine glands are seen scattered throughout these islands.



Fig. 4.—High power (140 diameters) showing the columnar character of the epithelium lining the glandular tubules. A focal area of mononuclear leucocytes is seen between the acini.

has made a thorough study of this subject, criticizes this term on the grounds that it implies a blastoma. He also points out that at the present time it is not known whether these are real blastomata or instances of hyperplasia. For this reason he objects to fibroadenomyosis which is favored by many German writers, and considering this evidence Nicholson employs, particularly for the extrauterine type, the more noncommittal term "endometrial tumor."

Sampson,<sup>10</sup> as a result of his extensive work on the heterotopic forms, concludes that there is a difference between uterine adenomyoma and the extrapelvic growths. He considers the former a direct or primary endometriosis and calls the latter "endometrial

implants." Other terms as müllerianoma, adenofibromyoma, adenomyohyperplasia, etc., have been offered but not generally accepted. It can, therefore, be concluded that this controversy relative to a common acceptable term indicates that the exact etiology and histogenesis of these heterotopic forms are still in dispute, and until some agreement is reached it is well to consider them as "endometrial growths," and distinct from uterine adenomyomata.

Coincident with the varied nomenclature are numerous theories on the formation of these ectopic growths, but as this report concerns only those tumors directly connected with the uterus, only brief mention will be made of the many possible methods of origin that have been ascribed to these heterotopic forms. Michon and Comte<sup>7</sup> give a concise review of the various pathogenic theories which they classify as either acquired or congenital. The gist of these various hypotheses listed in their résumé being embodied in either embryonic



Fig. 5.—High power (140 diameters) showing the flattened epithelium of a large dilated tubule. The surrounding endometrial stroma is scanty, and the epithelial cells lie almost directly upon the fibromyomatous tissue.

rests, metaplasia of preexisting peritoneum, or implantation during adult life, either directly, or by metastasis through the lymphatic or venous channels.

In considering the formation of the uterine adenomyomata it is well to repeat Cullen's description of mucosal extension into the muscular wall, as this is the theory universally accepted today. In his book he mentions that by careful sectioning, this continuity could be traced in every one of fifty cases of diffuse adenomyomata. This connection has also been demonstrated by Burg,<sup>3</sup> and others. By injection, Burg found that many of the invading columns even anastomose among themselves.

The actual factor that incites this mucosal invasion is, however, undetermined. It is impossible, with what is known, to attribute any exact cause to the formation of these tumors. That the disorder is acquired is indicated by the work of Schwartz and McNalley,<sup>13</sup> who,

after examining the mucosa of numerous infantile uteri, were unable to find any evidence of endometrial extension. Many investigators have noted the coincidence of adenomyomata and hyperplastic endometritis, and suggest that the latter may be primarily instrumental in the development of these growths.

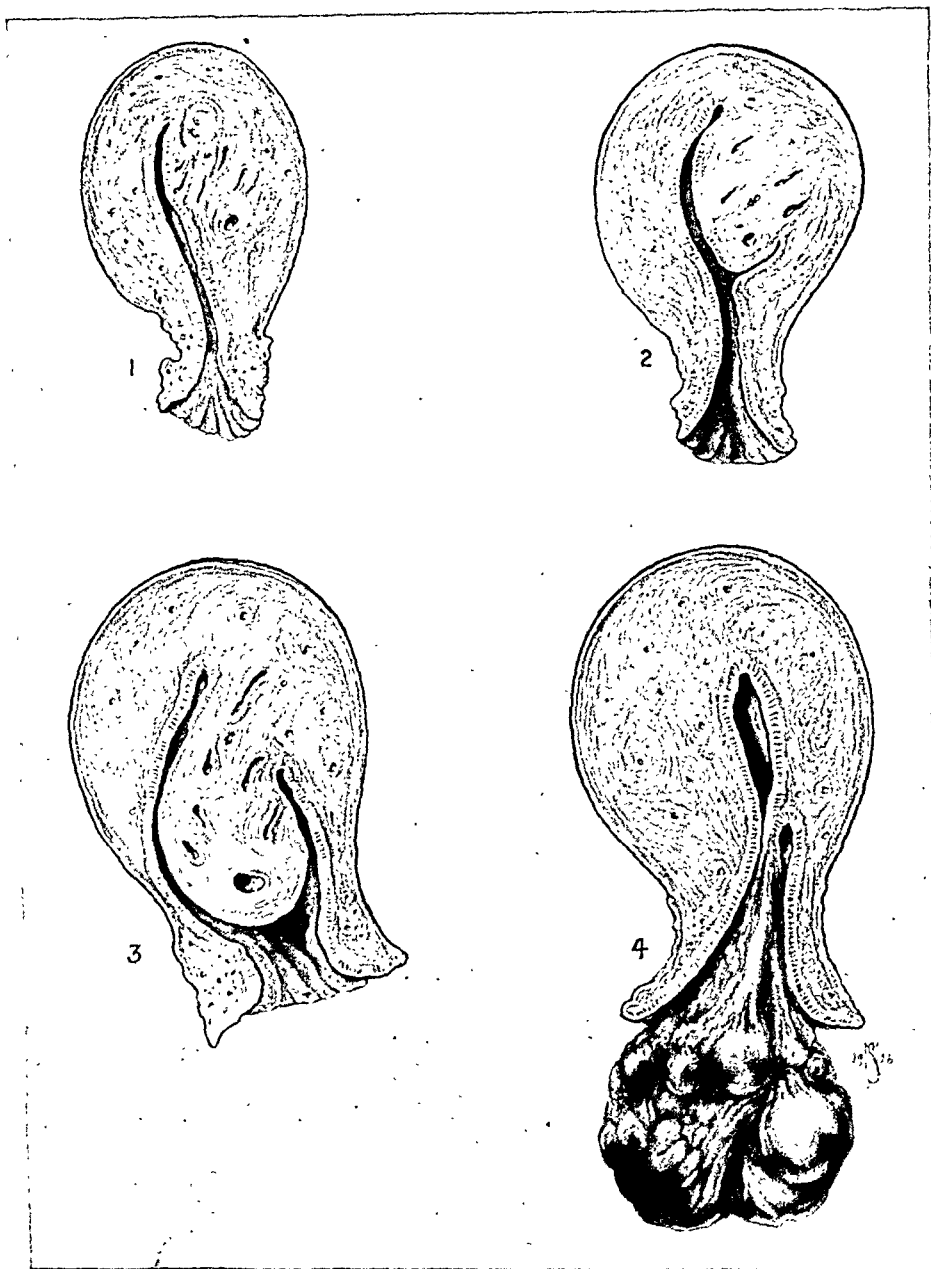


Fig. 6.—Diagrams showing the process in the formation of a submucous pedunculated cystic adenomyoma by isolation and expulsion of part of a diffuse adenomyomatous growth.

The process of mucosal invasion usually produces diffuse growths within the uterine wall, but in certain cases some isolated areas of a diffuse growth may, through uterine contraction, be extruded to the surface where they become either subperitoneal or submucous adeno-



myomata. The latter type is rare. Among the 83 cases reported in his book, Cullen lists 7 as submucous growths, with a case (No. 7076) that is very much like the one reported here. He originally described the method of formation, which Baldy and Longcope<sup>1</sup> confirm, as consisting in the segregation of portions of a diffuse adenomyoma, with the progressive expulsion of some of these into the lumen of the uterus as submucous nodules, and finally a protrusion of the growth through the cervix as a pedunculated tumor. A case of Cullen's is used to illustrate the primary separation of a small submucous growth from a large diffuse adenomyoma, supplemented with one described by Schatz,<sup>12</sup> where several submucous nodules extended into the lumen of the uterus, followed by the stage of expulsion in Diesterweg's case,<sup>5</sup> where the tumor protruded through the external os. The steps of this process are diagrammatically represented in the accompanying group of illustrations.

An unusual feature of the case reported here is the tendency to cyst formation. This condition is doubtless caused by the hemorrhage into the glandular spaces, combined with the release of pressure of the surrounding myometrium as the growth is extruded into the vaginal canal. Another causative factor is the marked proliferation of the fibromyomatous tissue which tends to cause a dilatation and distortion of the preexisting glandular cavities.

#### CASE REPORT

The patient was operated upon August 5, 1926 by Dr. D. E. Smith at Providence Hospital, Kansas City, Kansas, and it is through his kindness that this case is being published.

Unfortunately however, this woman was admitted through the out-patient department, therefore a detailed physical examination and laboratory report are not included. The patient, Miss H., a middle-aged nullipara, complained of a feeling of fullness in the pelvis, and menorrhagia, usually accompanied by pain and discomfort. The past history was essentially negative. Pelvic examination revealed a large tumor mass that completely filled the vagina. This growth was impacted to such an extent that the examining finger could not enter the vaginal introitus. The tumor was removed with difficulty, and was attached to the wall of the uterine cavity above the internal os, by an irregular pedicle about 2 centimeters in diameter. This pedicle was severed with very little subsequent hemorrhage. The patient left the hospital the same day, and recovery has been uneventful.

*Gross Pathology.*—The irregular, rounded, tumor mass, measured 10 by 8 by 5 centimeters, weighed 152 grams and had a firm, elastic, consistency except in certain cystic areas. These cysts protruded from the surface to give it a nodular appearance. Under these raised areas were both thick and thin walled cavities, some of which were empty, while others contained a dark red hemorrhagic substance, which gave the tumor a mottled, dark red, and grayish color.

The tissue on section was composed for the most part of pale fibrous tissue in which are poorly circumscribed cellular appearing areas. Scattered throughout the latter are many small, irregular, cleft-like spaces. Within the more fibrous portion there were numerous empty and partly collapsed cystic cavities with a smooth, pale lining. In a few of these there was some old hemorrhagic material.

*Histologic Examination.*—Sections show larger and smaller islands of endometrial tissue embedded in a fibromyomatous stroma. In this endometrial tissue are glands identical with those of the normal endometrium, with a cellular stroma typical of this region. There are also many cystic spaces lined by columnar epithelium representing dilated endometrial glands. Some of these cysts are distorted and contain a granular eosin staining material with a variable number of red blood cells and bits of desquamated epithelium. Others are empty and partly collapsed.

There is some variation in the type of epithelium lining these spaces. Around the smaller ones it is cylindrical while the larger cyst walls are lined with a single layer of low or flat epithelial cells. As a rule the large cystic spaces lie almost directly upon the fibromyomatous tissue, but the smaller glandular tubules are invariably surrounded by a mantle of cellular endometrial stroma.

The muscular and connective tissue elements greatly predominate in some places and often show an edematous appearance. There was some focal mononuclear infiltration at intervals throughout the endometrial stroma, and around some of the glands.

### CONCLUSIONS

1. There is reported here a case of a large pedunculated cystic adenomyoma of the uterus, embedded in, and occluding the vaginal canal.

2. There is obviously from our present knowledge a pathogenetic distinction between the heterotopic, and the uterine adenomyomata.

3. The term "adenomyoma" is generally used for those growths that are limited to the uterus, and until a definite pathogenesis is established, the heterotopic forms are best called "endometrial tumors."

4. The theory for the formation of the diffuse uterine type by endometrial invasion is universally accepted, but the exact causative factor inciting the ingrowth is not known.

5. The submucous pedunculated type represents the reaction of the uterus in expelling certain localized areas of a diffuse growth which may in turn become cystic.

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THIRTY-NINTH AND HUDSON ROAD.

# THE X-RAY TREATMENT OF AMENORRHEA, WITH A REPORT OF THIRTY-EIGHT CASES\*

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THE treatment of amenorrhea by x-rays, although not a new procedure, has recently raised the question as to the advisability of its use, particularly in such cases where a subsequent pregnancy is desired or may result.

A warning against its unfavorable sequelae has been sounded by some workers who based their assumptions on the findings in animal experimentation and on the observation of abnormal children born of irradiated parents. Werner reports on the birth of twenty monstrosities following maternal irradiation. Penzoldt reports some Mongolian births following treatment and excessive exposure of the parents to x-rays. Penzoldt states that pregnancy occurring within four months following x-ray treatments may cause abnormalities in the child.

In contrast to these reports are the good results following x-ray treatment reported by Rubin, Hirsch, Flatau and others who have used x-rays as a means of correcting amenorrhea and its concomitant sterility. Lenks says that, by applying small doses of x-rays to the ovaries, acquired amenorrhea of not too long standing can be relieved. My own results in the thirty-eight cases herewith reported have shown no untoward sequelae and suggest that x-ray when properly used is an excellent therapeutic agent for the treatment of an ovarian dysfunction.

Just how the x-ray works on the internal mechanism of the female that controls the menstrual phenomena is not quite clear. Whether it is a stimulus to ovulation and thus prepares the field for impregnation, or whether x-rays inhibit some prohibiting action on the part of the female organism preventing menstruation and subsequent pregnancy, I am at this time unable to say.

Martius says that any change in the living reactions of the cell is a stimulation response. If this stimulation is too strong, death ensues to the cell; if moderate, paralysis may occur; if weak, an actual stimulation to increased cell activity may take place. He does not believe that the x-rays themselves stimulate. Flatau speaks of the direct stimulation action of x-rays on the ovary, while Thaler states that the action is on the corpus luteum, that the x-rays destroy the yellow bodies and correct the amenorrhea of corpus luteum origin. Thaler, also, suggests some protein change in the blood due to weak x-ray dosage which may account for the

\*Read at a meeting of the Section on Obstetrics and Gynecology at the New York Academy of Medicine, May 22, 1927.

so-called stimulation phenomenon. Seitz and Wintz speak of a definite stimulation of the ovary. Penzoldt believes the graafian cells are more radiation sensitive than the primary follicles. Geller states that weak x-rays destroy these first line *anlage* cells of inferior quality allowing the regular four weekly period with replacement of normal follicles and that this breaking of the cell blockade allows normal menstruation to take place. Aschoff, Colwell and Russ have shown that x-rays act directly on the follicular elements of the ovaries. Lenks says that the x-rays act on the ovaries by eliminating a pathologic graafian follicle, the presence of which prevents the ripening of the normal follicle. He says there is no direct stimulating action on the ovaries. Hirsch believes the x-rays act on the corpora lutea. Robinson states the ovule is the most sensitive part in the follicle and that the tertiary follicles are the most vulnerable to x-rays, while the primary follicles are not affected and continue to ovulate after the irradiation effect passes over.

Bagg from his experimentation with white mice suggests a direct action of the x-rays on the parental organs of reproduction. He concludes that x-rays lead to monstrosities in the offspring. Martius, too, quotes several German workers who have come to the same conclusion, but Martius agrees that from observation on human beings no broad conclusions as to the abnormal results can as yet be drawn. Robinson says that the fear that irradiated women will give birth to monstrosities or mentally defective children has thus far not been substantiated by experimental or clinical facts.

Nürnbergger states that there is not sufficient proof to show injurious external manifestations in the offspring and that more than irradiation injury is necessary to explain the alteration in hereditary transmission of the character germ to the embryo. He also feels that the germ poison theory still has to be proved and that the x-rays produce such a germ poison affecting the ovum.

Schmitt draws attention to the fact that these workers have been using castration doses leading to either permanent or temporary cessation of the menses, and that subsequent pregnancies occurring in these excessively radiated parents produce abnormal offspring. Flasskamp states that practical experience and not conjectures governs the question of irradiating or not irradiating the human ovaries. He notes that there is an absence of proper reporting of results in the experimental irradiation of ovaries, where no distinction is made between weak irradiation and doses leading to temporary or permanent sterility, nor does he believe all reported so-called child injuries due to the effects of previous irradiation. Micheal Levine working along the same lines as Bagg has failed to substantiate Baggs's findings—on the contrary his results were consistently good. Monstrosities have occurred in cases never radiated.

Whether x-ray treatment influences the result or not, is still an undetermined matter. I feel that, properly treated, no ill effect should result to the patient or to her offspring. Perhaps improper technic combined with an overdosage has caused these untoward results, which might explain the unfortunate sequelae subsequent to treatment reported by others.

Martius, although acknowledging that in animal experimentation these abnormal results do occur, feels, however, that the same conclusions as to untoward results in human beings are not warranted in the face of the actual satisfactory statistical report. One hesitates to compare on an equal basis such a complicated mysterious mechanism as that of the human reproductive function with results such as those

of Baggs occurring in white mice. Herman in discussing the question of roentgen treatment of amenorrhea reports a good result in the case of a young married woman with the subsequent birth of a normal healthy child. Flatau reports good results in twenty-six out of thirty-eight cases in one series, and ten out of twelve in a second, with four subsequent normal pregnancies. Other workers here, such as Rubin, Rongy, and Hirsch, have reported equally good results in their series of cases. The results we obtained in our thirty-eight irradiated cases certainly do not bear out the assumption of some workers that only evil can result from therapeutic use of the x-rays.

Of the thirty-eight cases herewith reported, eight were single and thirty were married women. Menstruation has followed the treatment in all but eight cases. Of the married women pregnancy was desired in twenty-five and was secured in eleven of these cases. In two cases pregnancy followed immediately after treatment. One case has had two pregnancies with the birth of two normal children; one child was born one year after the first. Of the eleven pregnancies, seven normal, healthy children have already been born. Four cases treated had had children previously; of these, two wanted relief from early menopausal symptoms and two wanted children. Of the thirty-eight cases, eleven had had previous operations; of the latter, three had had some sort of mechanical treatment before radiation. One case menstruated but twice in fifteen years, starting at the age of sixteen.

The technic used was as follows: In all cases, high voltage x-rays, 200 KV, 4 MA, 0.5 copper, 1 aluminum filter, 23-30 centimeters distance, 6 x 8 and 9 x 12 centimeter portals. The treatment was given over the right and left anterior and posterior ovarian areas, with alternate doses about one week apart. The total dosage on the ovaries varied between 10-15 per cent of the skin erythema dose.

The symptoms were:

Amenorrhea .....	25 cases
Irregular menstruation .....	10 cases
Scanty with pains .....	1 case
Dysmenorrhea .....	1 case
Lack of Pregnancy .....	1 case

#### *Summary*

Total cases treated .....	38
Positive results .....	30
Negative results .....	8

#### *Marital State*

Single .....	8
Married .....	30

#### *Ages*

Youngest .....	19
Oldest .....	45

*Symptoms*

Amenorrhea .....	26
Irreg. Menstruation .....	10
Dysmenorrhea .....	1
Lack of Pregnancy.....	1

*Last Period Before Menstruation*

Never menstruated .....	1
Menstruated 32 mo. before.....	1
Irreg. with several months pause....	36

*Results*

Single cases .....	8
Menstruated .....	5
No result .....	3
Married cases .....	30
Menstruated .....	27
No result .....	3
Pregnancy .....	11
Births .....	7
Pregnant and Miscarried.....	2
Still Pregnant .....	2

*Pregnancy Took Place*

2 cases immediately after treatment		
1 case 3 mo.	"	"
1 case 4 mo.	"	"
1 case 5 mo.	"	"
1 case 9 mo.	"	"
1 case 10 mo.	"	"
3 cases 12 mo.	"	"
1 case 15 mo.	"	"

## CONCLUSIONS

1. Amenorrhea and sterility may be treated with the x-ray.
2. When properly treated no harm ensues to the patient or to her offspring.
3. Abnormal children have not been born in our series of radiated cases.

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# LIPIODOL AND ROENTGEN RAY AS A DIAGNOSTIC AID IN GYNECOLOGY\*

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IN GYNECOLOGIC diagnosis the roentgen-ray examination with an opaque medium has a range of usefulness directly in proportion to the completeness of the technic and the ability of the operator to interpret the roentgenograms. As an adjunct and not to replace standard procedures this method is invaluable. With pneumoperitoneum, barium mixture in the colon or air inflation of the bladder, important points may be demonstrated. This method as a diagnostic aid in gynecology is of recent development. Cary in 1914 suggested and used a solution of collargol in the living subject; since that time various mixtures have been tried.

Sampson in 1918 by injecting extirpated uteri with bismuth subcarbonate in gelatine was able to demonstrate the possible danger of forcing foreign material into the uterus of a living woman, when a curettement has been performed, as the substance may enter the uterine veins exposed by the operation, and the absence of danger when the endometrium is intact. Geist and Goldberger used extirpated uteri with tubes attached for injecting a 20 per cent solution of sodium iodide, to corroborate the findings of Hermstein and Neustadt regarding the peculiar course followed by the intramural portion of the fallopian tubes.

Kennedy in 1923 used a 20 per cent solution of sodium bromide injected into the uterus and tubes and reached the following conclusions:

A. In view of Sampson's work no injection should be made in any case where there is evidence of active bleeding.

B. The internal os can withstand a pressure of 200 mm. of mercury in the cervical canal without its musculature allowing the passage of any solution into the uterine cavity.

C. That many isthmi while permitting the sodium bromide solution to pass through their canals, can overcome a pressure of 200 mm. of mercury and expel their contents in either direction.

D. 30.8 per cent of the tubes examined were occluded at the isthmus. 69.2 per cent were occluded at the fimbria.

The illustrations which accompany his article lack the definition that can be produced when using one of the iodized oil preparations.

Rubin, first using a collargol solution and later other opaque media, was able to demonstrate patency or nonpatency of the fallopian tubes. In the patients with patency the pelvic irritation was too great to continue their use.

Kennedy in July, 1925, using a solution of 20 per cent sodium bromide demonstrated the possibility of isthmospasm causing an obstruction to the passage of active spermatozoa in certain cases of sterility, producing so-called selective sterility, with tubes otherwise normal. A similar condition may be excited by an insuff-

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\*Read at a meeting of the Chicago Gynecological Society, June 17, 1927.

flation test and must be thought of when one finds an apparent obstruction; also when a gas patency test precedes the injection of an opaque substance, preventing the material from entering the tubes.

In the past two years there has been a great deal of investigation both in this country and abroad with preparations of iodine in oil. Lipiodol, the more commonly used, is 40 per cent iodine in a vegetable oil base, iodipin is much the same. The general use of these substances is ample evidence of their superiority as contrast media in the roentgenologic delineation of cavities of moderate to small size. Originally used as a therapeutic agent for the slow absorption of the iodine content, they are now found to be of value in a great variety of conditions as diagnostic aids.

Putnam has within the past few months investigated the relative value of opaque oils for use in roentgenologic work. He has come to the conclusion that from a laboratory standpoint and a clinical one, animal oils are less irritating, more easily emulsified and more quickly absorbed than the vegetable oils as now used and that bromine substitution products rather than iodine addition compounds may be of greater radiographic value.

Dyroff, in his report of a new contrast medium which he named "contrastol," confirms the above. He claims that the iodine in lipiodol is not so firmly fixed as is assumed. It may cause irritation and possibly adhesions in the peritoneum. He further states that "contrastol" is a bromine compound in which the bromine is neither liberated at fairly high temperatures nor is it affected by acid or alkali within physiologic limits. From these two reports it may be concluded that the bromine combinations will be the better for this class of work. However, their superiority in practice has still to be proven as up to the present time most of the work has been done with iodized oils.

Rubin and Bendick report the observation of tubal peristalsis by roentgenoscopic examination. They made fluoroscopic examinations and roentgenograms at frequent intervals. These workers have come to the conclusion that because of the action of the anesthetic, during operation, tubal peristalsis has not previously been observed. It is dependent on ovarian activity and will vary with the menstrual cycle. Dyroff, in a like manner, was able to observe the phenomenon of tubal peristalsis.

Reinberg and Arnstam, using lipiodol, have made extensive studies of the physiologic action of the uterus and tubes, and to determine the diagnostic value of the method.

Nahmmacher reports in detail the various contraction waves noted in the uterine wall depending on the condition of the musculature during metritis and with uterine tumors.

Heuser reports the use of lipiodol injections as a means of diagnosing pregnancy in the early weeks. He carried out his technic on a number of patients without interfering with the normal course in a single instance. The first patients were ill with advanced pulmonary tuberculosis; and he desired to empty the uterus but failed to accomplish this with the injections. On other patients he used the method to make the diagnosis of pregnancy as early as the third or fourth week. A filling defect on one side of the uterine cavity with lack of muscle tone as shown by outline irregularity and unevenness of the cavity shadow was the characteristic finding. His example has been followed by others but so far I have not seen any reports from this country.

Stein and Arens of Chicago, made a preliminary report October 16, 1926, on the use of iodized oil in conjunction with pneumoperitoneum and roentgen ray. The advantage of having organ outline as well as cavity delineation is considerable.

The technic of lipiodol injection in the uterus and tubes is not complicated; careful asepsis should be followed, bearing in mind the pos-



sibility of forcing material through into the pelvic cavity, a danger which is not so great as it may seem. Acute conditions of the cervix should first be treated to render them less active; bleeding patients if injected at all should be handled with caution. An insufflation may precede the lipiodol injection, depending on the information desired. An all glass or a record syringe with 10 c.c. of lipiodol is attached to the cannula that is used for insufflation; pressure sufficient to prevent back flow is exerted against the cervix. Where the uterus is freely movable it may be necessary to pull down on the cervix against the rubber acorn with a single tooth tenaculum. As the material fills the uterine cavity, especially where there is occlusion of the tubes, a feeling of pain may be complained of; by delaying pressure for a short time this will pass, after which the entire procedure may be completed without further discomfort. Often patency can be determined by the ease with which the oil passes in. A roentgenogram taken immediately after the injection is completed and before the cannula is removed is informative; a second one shortly after will show the progress made in the tubal filling; a third view after the instrument is removed will give an idea as to the rapidity with which the uterine cavity empties itself.

#### CONCLUSIONS

As a means of determining tubal patency with a permanent clinical record, the method has no equal.

In a large group of sterility patients it might be possible, with the aid of roentgenograms, to determine when surgical relief is indicated.

Anatomic or pathologic alteration in the uterus and tubes can usually be palpated bimanually; here is a method that may aid in diagnosing functional conditions.

A study of the physiologic action of the genital organs will make a separate chapter in the use of this method.

The application is so simple and the danger so slight I believe the method worthy of use.

Following is a group of lantern slides from roentgenograms which will illustrate the use of a contrast medium in gynecologic diagnosis.

I wish to thank Professor Adolph Hartung for his many suggestions and kind cooperation in completing this work.

#### CASE REPORTS

CASE 1.—Mrs. F. H., aged thirty-two, American, married eighteen years, primary sterility. Facial evidence of congenital syphilis. Menstruation began at fourteen and was regular; duration was three days, painless. Previous operation, February, 1926, abdominal tumor and one ovary removed. Present complaint; sterility, pain in back, amenorrhea past two months. Uterus small and freely movable, no adnexal thickening. Wassermann test now negative. has taken antisyphilitic treatment

Tubes nonpatent at high pressure. Lipiodol injection, uterine cavity will hold small amount and roentgenogram reveals small uterine cavity shadow cast, infantile type of uterus, two or three drops seen in right isthmus, none passing into the tubes. Check up several days later shows no lipiodol in the pelvic cavity.



Fig. 1.—Case 1. Insufflation of tubes nonpatent at high pressure. Lipiodol injection, uterine cavity will hold small amount and roentgenogram reveals small uterine cavity shadow cast, infantile type of uterus, two or three drops seen in right isthmus none passing into the tubes. Check up several days later shows no lipiodol in the pelvic cavity.



Fig. 2.—Case 2. Insufflation of tubes, patency at 60 to 80 mm. of mercury pressure, lipiodol injection 10 c.c., roentgenogram reveals extensive uterine and tubal filling with oil free in pelvic cavity. Check up one week later, considerable lipiodol in pelvic cavity.

CASE 2.—Mrs. J. P., aged twenty-five, Austrian, married six years, two children, five and two, normal deliveries. Menstruation began at fourteen and was regular every 28 days; duration was three days, painless. One year ago, frequency and burning on urination, discharge. Gonorrheal complement-fixation test four-plus,

Wassermann test negative. Uterus in normal position, movable, cervix normal in appearance, little discharge. Insufflation of tubes, patency at 60 to 80 mm. of mercury pressure, lipiodol injection 10 c.c., roentgenogram reveals extensive uterine and tubal filling with oil free in pelvic cavity. Check up one week later, considerable lipiodol in pelvic cavity.

CASE 3.—Mrs. F. G., aged twenty-seven, married two years, primary sterility. Menstruation began at thirteen, regular. Present complaint; sterility and ab-



Fig. 3.—Case 3. Insufflation of tubes, gas passes in at 120 mm. of mercury pressure, right shoulder pains and subdiaphragmatic fullness on leaving the table. Lipiodol 7 c.c., roentgenograms, uterine cavity and both tubes filled also lipiodol free in the pelvic cavity.

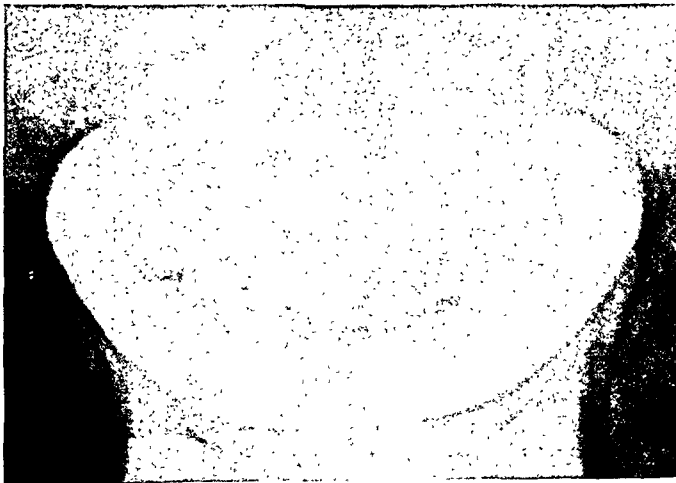


Fig. 4.—Case 3. Check up one week later confirms the patency of the tubes.

dominal pains (vague). Wassermann test negative. Uterus moderate size, retro-displaced, no adnexal masses, small amount of clear cervical discharge. Insufflation of tubes, gas passes in at 120 mm. of mercury pressure, right shoulder pains and subdiaphragmatic fullness on leaving the table. Lipiodol 7 c.c., roentgenograms, uterine cavity and both tubes filled, also lipiodol free in the pelvic cavity. Check up one week later confirms the patency of the tubes.

CASE 4.—Mrs. R. F., aged thirty-nine, American, married twenty years, two miscarriages eighteen and nineteen years ago. Menstruation began at sixteen, regular every 28 days; duration five days. Operation seventeen years ago, tubal pregnancy with rupture, two years later developed a pelvic abscess which was drained. Patient was told at that time the condition might be tuberculous. Backache and pain in lower abdomen, at each defecation a large hemorrhoidal mass protrudes almost to the extent of prolapse. Examination: Medical Department, Wassermann test negative, erythrocytes 3,000,000 and a white cell count of 6650.

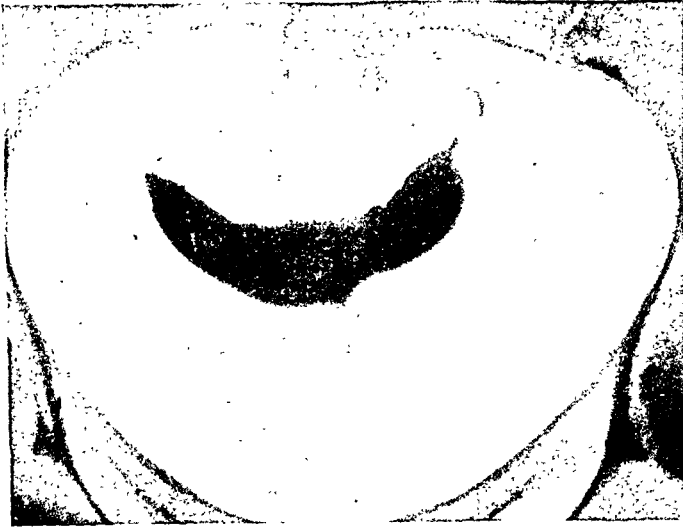


Fig. 5.—Case 4. Insufflation of tubes, nonpatent at 200 mm. of mercury pressure. Lipiodol injection under low pressure 10 c.c., roentgenogram, large uterine cavity shadow cast which extends into the left tube, irregularity of the outline noted.



Fig. 6.—Case 5. First film shows right uterine horn filled, tube which extends beyond apex also filled to the end.

Fluoroscopic of chest and roentgenograms reveals evidence of old hilum tuberculosis. Pelvic examination: extreme retrodisplacement with fundus just within the introitus, cervix smooth, leucorrhea moderate. Insufflation of tubes, nonpatent at 200 mm. of mercury pressure. Lipiodol injection under low pressure 10 c.c., roentgenogram, large uterine cavity shadow cast which extends into left tube, irregularity of the outline noted.

CASE 5.—Mrs. E. H., aged twenty-five, American, married seven years, miscarriage seven years ago, during the early weeks of pregnancy. Menstruation began

at thirteen, regular; 28 day type, duration five days. Previous operation, seven years ago directly after induced miscarriage, left horn of a double uterus, with left ovary removed. Present complaint: pain in right side lower quadrant and copious leucorrheal discharge. Wassermann test with blood and spinal fluid negative. gonorrheal complement-fixation test negative. External genitals normal in appearance until labia are separated when a septum is seen which extends up to the vault from 2 cm. within the introitus. Inspection of right cervix, smaller than normal, no laceration, considerable mucopus yellow leucorrhea, mass palpable on



Fig. 7.—Case 5. Small amount of lipiodol injected under greater pressure, this can be seen in left cavity and both cannulas in place.



Fig. 8.—Case 5. Right cannula removed permitting the horn to empty and tube to be more clearly seen.

this side of the pelvis which is very tender. Inspection of left cervix, normal in size with discharge much as on the other side seen, no mass evident on the left side. Two series of roentgenograms were taken in this case. Speculum placed in right vagina, cannula inserted in cervix, lipiodol injected, low pressure used until uterine cavity filled, first film shows right uterine horn filled, tube which extends beyond apex also filled to the end. Speculum removed from right vagina, cannula retained in right cervix, speculum then placed in left vagina and another cannula placed in left cervix, small amount of lipiodol injected under greater pressure, this can be seen in left cavity and both cannulas in place. Right cannula removed permitting

the horn to empty and tube to be more clearly seen. Fourth view after all instruments have been removed, very little seen in either cavity and right tube as before, considerable lipiodol in both vaginal tracts. Second series, with both vaginas filled with rubber cots which are then filled with barium carbonate mixture and again the cannulas inserted into the cervix on either side, lipiodol is then passed into each uterine cavity with much the same result as in the first series. Check up after all this lipiodol injection does not reveal the smallest drop remaining.



Fig. 9.—Case 5. Fourth view after all instruments have been removed, very little seen in either cavity and right tube as before, considerable lipiodol in both vaginal tracts.



Fig. 10.—Case 5. Second series, with both vaginas filled with rubber cots which are then filled with barium carbonate mixture.

CASE 6.—Mrs. F. D., aged thirty-seven, American, married twenty years, two children fifteen and four and one-half years. Menstruation began at thirteen, regular; duration four or five days, normal in amount until four and one-half months ago, at that time had what seemed a miscarriage and since then has been bleeding some each day, no cramps, passes clots at times. Wassermann test negative, relaxed pelvic outlet, moderate cystocele and rectocele, hypertrophy of the anterior cervical lip, stellate laceration, erosion, uterus enlarged, soft and bleeding. Opera-

tion diagnostic curettage, the endometrium thicker than normal, hyperplasia of the glandular elements, no malignancy. The following six weeks patient was free from bleeding after which the bleeding gradually increased until deep roentgen-ray therapy was administered; this controlled the hemorrhage. Insufflation proved the tubes patent, lipiodol was injected and a good uterine cavity outline obtained. an irregular surface across the fundus, also contraction waves seen on the right side, both tubes filled to the ends.



Fig. 11.—Case 6. Insufflation proved the tubes patent, lipiodol was injected and a good uterine cavity outline obtained, an irregular surface across the fundus, both tubes filled to the ends.



Fig. 12.—Case 7. Insufflation of tubes, occlusion at 180 mm. of mercury pressure. Lipiodol injection, roentgenogram uterine cavity fills to normal size, normal position, both tubes are obstructed at distal interstitial portion. Check up four days later, no opaque substance in pelvis.

CASE 7.—Mrs. J. S., aged twenty-seven, married eight years, primary sterility. Menstruation began at eleven, after fifteen lessened in amount, duration one day, the past three months there has been just a show for part of a day, no history of pelvic or genital inflammation. Wassermann test negative, moderate obesity, uterus normal size, freely movable, no tumor masses laterally, cervix clean, no leucorrhea. Diagnosis, obesity and ovarian hypofunction. Insufflation of tubes, occlusion at 180 mm. of mercury pressure. Lipiodol injection, roentgenogram

uterine cavity fills to normal size, normal position, both tubes are obstructed at distal interstitial portion. Check up four days later no opaque substance in pelvis.

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(For discussion, see page 719.)

## AN ANALYSIS OF SIXTY-FOUR CASES OF PLACENTA PREVIA

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THE cases which form the basis of this report occurred during the years 1920-26, inclusive, and while they were referred from many sources, including our own out-patient department, were treated wholly by the obstetric staff of the hospital, so that any criticisms we may make are largely criticisms of our own conduct. During the seven year period in which these cases were seen, there were 2940 admissions to the maternity, giving an incidence for placenta previa of 2.17 per cent. The maternity, however, receives a number of pathologic cases from the surrounding territory so that these figures are not reliable in estimating the incidence of this condition. Of much greater interest is the incidence in our out-patient department where, in 6579 consecutive cases, placenta previa occurred 13 times, or in 0.197 per cent of the cases. Depkin reports an incidence of 2 per cent and von Mikulicz one of 1.74 per cent, an apparent discrepancy which is probably explained by our large negro clinic, to which reference is made in a later paragraph.

The ages of out-patients varied from 16 to 51 years, the average being 31. Between the ages of 16 and 29 there were 32 cases, between 30 and 39, 27; and between 40 and 51, 3. Lieberman gives the aver-



age as 29.02 years, with the largest number of cases occurring between the ages of 26 and 36.

Of the 64 cases, 49 occurred in white and 15 in colored patients. Since 71 per cent of the obstetric admissions to the hospital are colored women, and in our out-patient department about 85 per cent so, this is a very interesting observation, and is hard to understand, for the supposedly etiologic factors of placenta previa are certainly as prevalent, if not more so, in this race. This same preponderance in whites is also reported by Thompson.

In our group there were 11 primiparae (17.2 per cent) and 53 multiparae (82.8 per cent), the largest number of pregnancies in any one case being 15. The average per patient was 5.42.

There were 18 cases occurring before the 36th week of pregnancy, 9 between 36 and 38, 35 between 38 weeks and term, and 2 cases in which the duration is not recorded. Placenta previa is essentially a disease of the last trimester of pregnancy.

The central type of placenta previa occurred 15 times (23.4 per cent), marginal 22 times (34.3 per cent), lateral 21 times (32.8 per cent), low implantation of the placenta once (1.55 per cent), and 5 cases not definitely typed (7.8 per cent).

In this group of 64 cases, 36 were treated by internal podalic version and breech extraction, after completing the dilatation of the almost completely dilated cervix, 3 by breech extraction alone, since the breech was presenting, 14 by abdominal cesarean section, and 1 by high forceps. It was felt safe to allow the remaining 10 to deliver spontaneously, since they were in active labor when seen and bleeding was being controlled very effectively by the presenting part. Half of the number delivered by cesarean section were primiparae.

The total maternal morbidity was 13 or 20.3 per cent, four instances being in the cesareans and six in the versions and breech extractions. These all developed a mild type of puerperal infection and ran a fever of between 101° F. and 102° F. for several days and made an uneventful recovery.

The maternal mortality was 4, or 6.25 per cent, all of which occurred in the cases delivered by internal podalic version and breech extraction. The causes of death were: ruptured uterus, one; operative shock (probably deep cervical lacerations), one; puerperal infection, one; while in the last case the patient was practically moribund from hemorrhage upon admission and delivery was a more or less perfunctory procedure on our part.

There were 35 fetal deaths or 53.8 per cent, of which number 14 were prematurely stillborn, 12 prematurely born alive and living only a short time and 9 full-term stillborn. There were 22 fetal deaths following internal podalic version and breech extraction, two after breech extraction alone, one after high forceps, one after cesarean section, and nine after spontaneous labor.

The various methods of handling the cases give us, therefore, the following results:

	NO. OF CASES		MATERNAL MORTALITY	FETAL MORTALITY
Internal Podalic Version and Breech Extraction	36	56.25%	4 or 11.11% cases so treated	22 or 61.11%
Breech Extraction alone	3	4.72%	0	2 or 66.66%
Forceps	1	1.56%	0	1 or 100.00%
Cesarean Section	14	21.87%	0	1 or 7.14%
Spontaneous Labor	10	15.60%	0	9 or 90.00%
Total	64	100.00%	4 6.25%	35 53.8 %

#### DISCUSSION

With regard to the incidence of placenta previa, our figures seem to agree with those of the majority of the observers, the low figures being explained, rather unsatisfactorily it is true, by the large number of colored patients handled in our clinic.

The maternal mortality rate is low if compared to other published reports. Various writers give a maternal mortality of from 9 per cent to 13.79 per cent for cases delivered by internal podalic version and breech extraction. Cesarean section has produced a maternal mortality of from 1.5 per cent to 3.6 per cent. Ours to date is *nil*. It is interesting to observe that ten of our cases delivered spontaneously, without a single maternal death.

The fetal mortality is high, but is apparently unavoidable. In regard to the 35 fetal deaths, on the other hand, attention is again called to the fact that 26 of them were in premature infants. Thirty-four of the deaths were in babies born per vaginam, and only one in those delivered by cesarean section. The highest fetal mortality (90 per cent) was in those cases which were permitted to deliver themselves spontaneously. The argument has often been advanced that cesarean section was unjustifiable in placenta previa, inasmuch as the life of the child would probably be lost anyway, but not only our own findings, but those of many observers would indicate that the fetal as well as the maternal mortality would be greatly reduced by the more general use of this operation.

In later years we have been resorting to section more and more freely in treating placenta previa, and feel that the results fully justify this procedure. However, we firmly believe that whatever good results have been obtained in our clinic, have been largely due to two factors. The first is that we have always taught and practiced immediate delivery in these cases, and the second that every effort is made to conserve blood and combat shock immediately. While to the majority of readers, these measures may seem self-evident, it is surprising how often they are not carried out, delivery being delayed until morning or some other suitable time if the patient is not bleeding

upon admission, and does not seem to be *in extremis* from loss of blood. We all know, of course, that a patient with a placenta previa may begin to bleed at any moment, and we must remember that a woman who has had a moderately severe hemorrhage may seem to be in fairly good condition, yet a small amount of fresh bleeding will be more than enough to seriously shock her and possibly cause death.

In making a diagnosis of placenta previa, we usually rely on the classic symptoms of painless, causeless hemorrhage in the last trimester, together with palpation of the lower uterine segment by rectal examination, and do not in many cases attempt to confirm the diagnosis by vaginal examination. We also believe that one hemorrhage is sufficient for diagnostic purposes, and do not feel that it is necessary to wait for a recurrence. We find that in this way many of the patients come to operation early and before they have been greatly shocked by the loss of blood. It is an invariable rule with us to empty the uterus *at once* in all cases of placenta previa, irrespective of the time of day or night, or convenience to the operator. We try to choose the most conservative method for each case, and find as time goes on that abdominal cesarean section seems to be the operation of choice in more and more of the cases. Whatever the type of operation, as soon as the patient is anesthetized, hypodermoclysis of normal salt solution is started and in more desperate cases this is augmented by intravenous fluids. Every effort is made during the entire delivery to prevent bleeding and shock to the patient. Manual dilatation of the cervix is not, of course, attempted unless the canal is entirely obliterated and the external os almost completely dilated already and very soft.

If the delivery is being accomplished per vaginam, as soon as the placenta has been expressed or removed manually, as the case may be, the uterus is at once packed tightly with gauze and the pack allowed to remain for twenty-four hours. This is done because not infrequently these patients will have a relaxation of the uterus and a serious, if not fatal, hemorrhage an hour or so postpartum, although the actual amount of blood lost may be very little.

In conclusion, we would once more call attention to the fact that any bleeding in these cases is serious, and no attempt should be made to empty the uterus until all known measures for controlling and combating hemorrhage are at hand and available for instant use.

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## AN OPERATION FOR THE CURE OF PROCIDENTIA OF THE UTERUS

By ARTHUR E. HERTZLER, M.D., HALSTEAD, KANSAS

IN COMPLETE procidentia of the uterus, this organ, together with the vaginal walls, protrudes outside the vulva. In the process of extravulvar migration, these structures carry with them to a greater or lesser extent both the bladder and the rectum. What troubles the patient most is disturbances of the bladder, as a result of the dragging of the prolapsed organs and, to a lesser extent, the disturbance of bowel function and irritation of the prolapsed mass on the thighs.

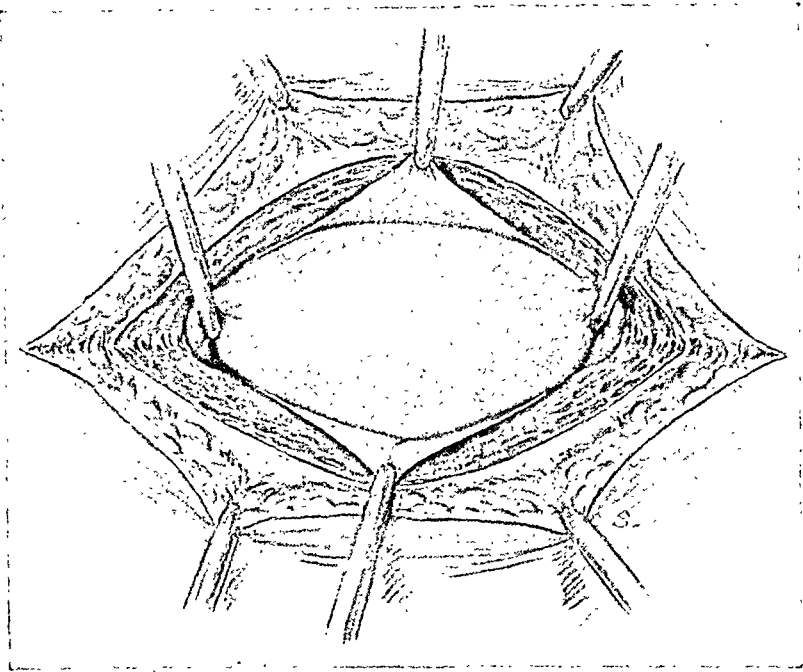


Fig. 1.

The operative indication in this condition is to restore the misplaced organs to their normal positions and keep them there.

The most primitive operation for the correction of this difficulty has been the removal of the uterus. The procedure is wholly illogical since the uterus is not the organ at fault. It merely travels along with the other organs because of old associations, as it were. After the uterus is removed, the vaginal cuff together with the rectum and bladder protrude as before. The attempt to hold up the vaginal cuff by shortening the broad ligament recognizes the difficulty to be corrected but is incapable to do so efficiently and permanently. My suggested operation, which consisted in the shortening of the broad liga-

ments without the removal of the uterus, was logical, but the broad ligaments are usually so attenuated in these conditions that they lack the strength to hold the prolapsed organs in place.

When one looks into the female pelvis, the subject of a procidentia, the uterus sticks up from the depth like a handle. The obvious thing to do is to catch hold of it and make traction. When this is done the procidentia disappears. Since it is inconvenient to keep on holding the uterus, the logical thing to do is to suture it to some fixed point. If the man who first saw a procidentia had called it a prolapsed bladder, no one could ever have thought of doing a hysterectomy.

The use of the uterus as a point of anchor to the fascia of the anterior wall has been employed by a number of surgeons. Most of them removed a part of the uterus and sutured the remaining parts

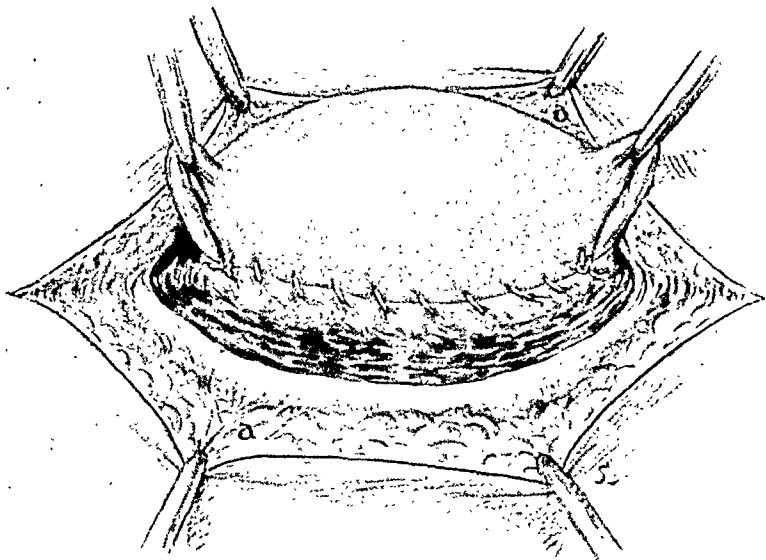


Fig. 2.

to the fascia. This opened into the uterine canal and often elevated the prolapsed parts too high. Others merely sutured the uterus to the fascia and other tissues. The uterus pulled loose and the procidentia returned.

The technic here proposed not only preserves the uterus to make a firm attachment to the abdominal wall, but it does so without opening into the uterine cavity. Sometimes the uterus seems to pull well out of the abdominal incision and there is a temptation to cut off a piece. To do so is a mistake, for if the fundus is attached, and suitable repairs are made below, the procidentia will cause no further trouble. If a part of the uterus is removed, bladder complaints are sure to follow. After using the method here described many years, there has not been a recurrence. A colporrhaphy and perineorrhaphy, if indicated, must precede the fixation and if done before the meno-

pause, the tubes must be clipped. If the cervix is unduly long, a part of it may be removed.

The technic is as follows:

A Pfannenstiel incision is made and the fundus of the uterus pulled into the incision (F'g. 1).

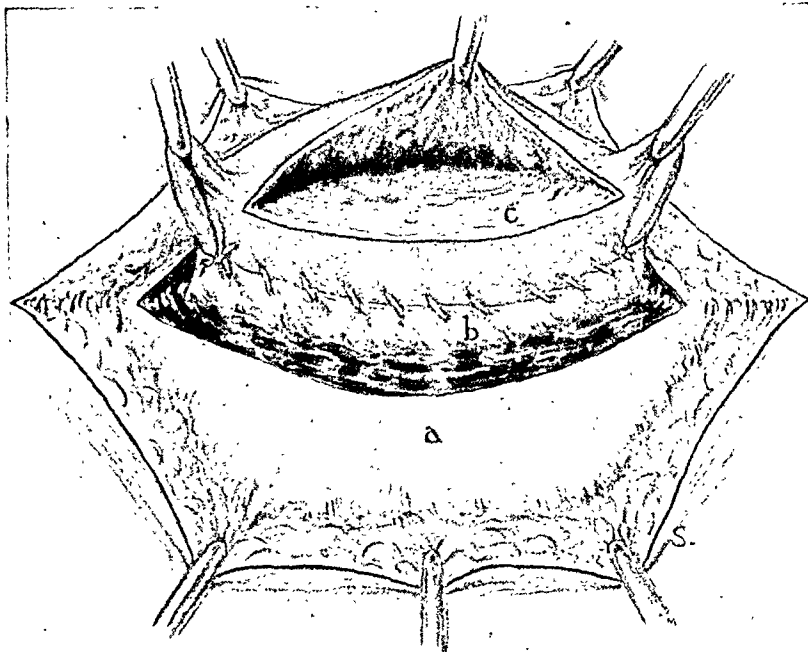


Fig. 3.

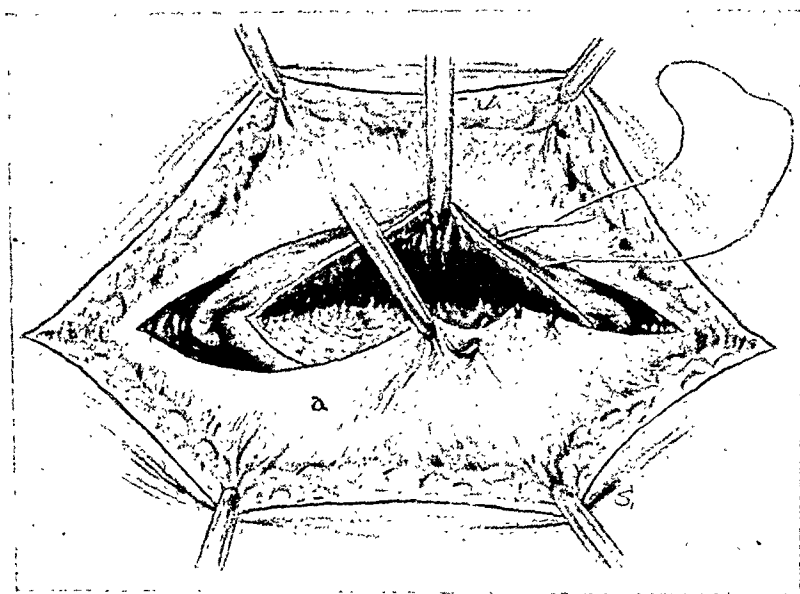


Fig. 4.

The peritoneum is sutured to the fundus of the uterus throughout its circumference making the fundus extraperitoneal (Fig. 2).

An incision is made in the fundus, making a partial flap of the top of the

uterus (*c*, Fig. 3); *a*, is the lower part of the abdominal fascia, *b*, is the line of suture shown in the preceding figure.

The lower fascia is drawn into the incision in the fundus, thus made throughout its entire length (Fig. 4 and *b*, Fig. 8). This maneuver is done something like the Mayo plication operation for umbilical hernia.

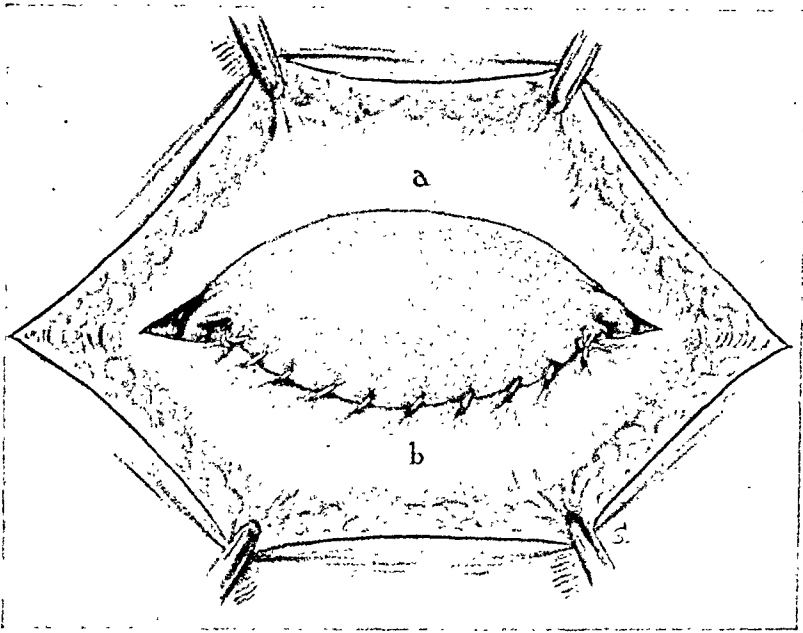


Fig. 5.

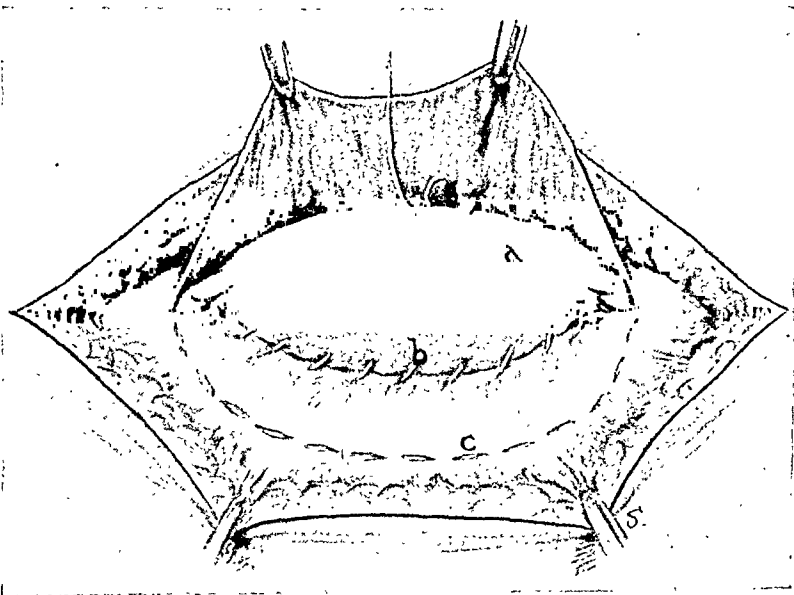


Fig. 6.

The edge of the flap formed by the top of the fundus is then sutured to the abdominal fascia from one corner of the uterus to the other (*b*, Fig. 5, *d*, Fig. 8). *A*, Fig. 5 is the under surface of the upper fascial flap.

The upper fascial flap is then sutured to the fundus of the uterus (Fig. 6 and *c*, Fig. 8). This is chiefly for the purpose of obliterating the dead space.

The edge of the upper fascial flap (*a*, Fig. 7) is then sutured to the lower

flap (*b*, Fig. 7). It is necessary to free this fascia from fatty tissue and it is well to make short nicks into it along the line (*c*, Fig. 6) where the upper flap is to be attached. This insures a firmer union.

The general plan of the operation is present in cross-section in Fig. 8. *A*, shows the line of suture of the peritoneum to the uterus (Fig. 1). *B*, shows the lower fascial flap drawn into the cut made into the fundus. The depth of the incision into the fundus is correctly shown here. Figs. 3 and 4 do not show the incision as deep as it should be. *C*, shows the suture of the lower edge of the upper fascial

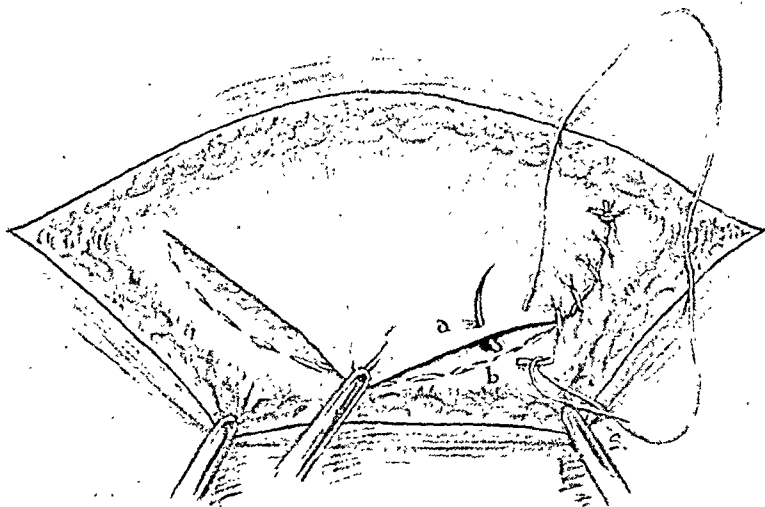


Fig. 7.

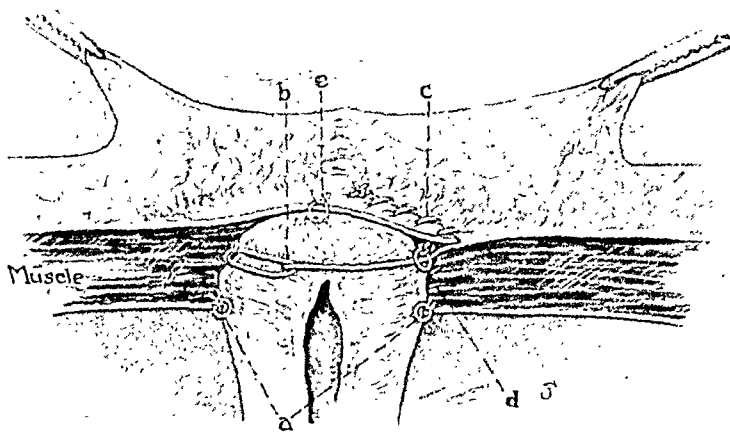


Fig. 8.

flap to the lower fascial flap (Fig. 7). *D* shows the suture of the edge of the uterus to the lower fascial flap (Fig. 5). *E* shows the suture of the upper fascial flap to the fundus of the uterus.

The infliction of the minimum of traumatism commends this operation, which may readily be performed under local anesthesia. I have never seen a recurrence following this procedure.



# A COMPARATIVE STUDY OF THE CONVALESCENCE OF ONE HUNDRED AND FIFTY SELECTED CASES OF VAGINAL, SUPRAVAGINAL, AND TOTAL ABDOMINAL HYSTERECTOMY\*

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THE apparently few complications occurring after vaginal hysterectomy as compared with those occurring after hysterectomy by abdominal section, has prompted us to make a study of the convalescence in the three types of hysterectomy. To eliminate as many complicating factors as possible in this comparative study, a strict limitation has been made upon the types of cases selected so as to make conditions uniform. This is a study of fifty cases of each type of hysterectomy selected *ad seriatum*, with the following prerequisites:

First, that the general preliminary examination reveal no physical defects outside of the pelvic findings which would make operation particularly hazardous.

Second, that the preoperative temperature is normal; the blood pressure within normal limits; the urine free from albumin, casts or sugar; the hemoglobin 70 per cent or above; the red blood cell count at least 3,500,000; the white blood cell count to not exceed 10,000.

Third, that the operative records show no evidence of malignancy or inflammatory condition in the pelvis.

The factors compared in the convalescence are:

First, the number of postoperative days of temperature over 100° F.

Second, the number of postoperative days spent in the hospital.

Third, the causes of mortality and morbidity. (See Table I.)

## DISCUSSION

It is safer to remove the uterus by vaginal hysterectomy when it is possible to do so. No deaths occurred in this group, and there is a definite decrease in the morbidity. Twice as many cases were afebrile in this group as compared to the other two types of hysterectomy.

When the uterus is to be removed by the abdominal route should the cervix be removed routinely as is frequently advised? This can only be answered by a study of balancing the risk associated with the removal of the cervix against the risk of leaving the cervix in.

There is an increase of 50 per cent in the morbidity when the cervix is removed and the average number of postoperative days spent in the hospital is increased by 3.68 days per patient.

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\*Read at a meeting of the Chicago Gynecological Society, June 17, 1927.

TABLE I

	VAGINAL HYSTERECTOMY	SUPRAVAGINAL HYSTERECTOMY	TOTAL ABDOMINAL HYSTERECTOMY
Postoperative days of temperature over 100° F.	Longest number of days over 100° F. 13 Number of afebrile cases 17 Average number of days 2.74 Shortest number of days 9 Longest number of days 21 Average number of days 14.76	Longest number of days over 100° F. 16 Number of afebrile cases 7 Average number of days 3.06 Shortest number of days 13 Longest number of days 29 Average number of days 15.12	Longest number of days over 100° F. 11 Number of afebrile cases 6 Average number of days 3.08 Shortest number of days 13 Longest number of days 41 Average number of days 18.8
Postoperative days in the hospital	One case postoperative hemorrhage. Died in 3 days and confirmed at post mortem	One case postoperative peritonitis. Died in 5 days and confirmed by post-mortem	One case postoperative peritonitis. Died in 5 days and confirmed by post-mortem
Mortality	No cases	Percentage 2%	Percentage 2%
Morbidity	Number of cases 5 Causes: Pyelitis 1 Infection of vaginal vault 4 Percentage 10%	Number of cases 6 Causes: Infection of vaginal vault 3 Hematoma vaginal vault 1 Postoperative arthritis, acute 1 One case returned 2 years later for removal of cervix with benign polyp. Percentage 12%	Number of cases 11 Causes: Pyelitis 1 Infection of abdominal wound 7 Infection of vaginal vault 1 Respiratory 1 Parotitis 1 Percentage 22%

On the other hand, only one case in the group of supravaginal hysterectomy returned for removal of the cervix and that was for a benign polyp. Out of 150 cases of supravaginal hysterectomy from which this selected group was taken, three cases returned for removal of the cervix; the case just referred to above and two others because of leucorrhea. There were no cases of malignancy. There is then a 2 per cent chance that a cervix left in at the time of operation will need subsequent surgical attention because of leucorrhea. The routine removal of the cervix for fear that malignancy or other disease might develop does not seem to be warranted when one considers the increased morbidity incident to its removal.

#### CONCLUSION

The removal of the uterus by the vaginal route at least in such cases that come within the limitations set for the above groups, is the safest operation. If the uterus is to be removed by the abdominal route, supravaginal hysterectomy is the safer operation since the danger that subsequent disease may develop in the cervix if left in is so completely overbalanced by the risk incident to the removal of the cervix.

*(For discussion, see page 720.)*

820 TOWER COURT.

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### A REPORT ON 320 FETAL POSTMORTEMS AT THE CHICAGO LYING-IN HOSPITAL\*

BY WILLIAM B. SERBIN, M.D., CHICAGO, ILL.

THE series reported here covers a period of six and one-half years from 1919 to 1926. There were 213 infant deaths, the extrauterine age ranging from twenty minutes to twenty days. In addition, there were 107 stillbirths of which 60 fetuses died during labor and 47 before labor began, with either early or advanced maceration. The sex incidence in both the deaths and stillbirths included 156 males and 164 females. With six exceptions infants under 1500 grams (3 pounds 5 ounces) were not included within this series. The exceptions were those infants which lived for several days and whose deaths were included in the hospital statistics.

From a purely obstetric standpoint the cases of greatest interest and those that were relatively frequent in occurrence were the cases of intracranial hemorrhage. The method employed in opening the skulls of these infants was that of Beneke. This method consists essentially of the removal of two oval plates of bone one on each side

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\*Read at a meeting of the Chicago Gynecological Society, May 20, 1927.

of the midline thus making two large windows exposing the cerebral hemispheres and cerebellum without destroying the sinuses or the tentorium cerebelli. By means of this method the blood vessels are avoided and any blood found in the cranial cavity cannot be attributed to technic.

There were 45 cases (14.1 per cent) of the series in which cerebral hemorrhage occurred following operative deliveries; viz., forceps, breech extraction and version and extraction. In addition, there were 18 cases (5.6 per cent) in spontaneous deliveries. The hemorrhages in the latter were less severe than in the former, cerebral congestion and edema being quite marked. Of these 18 cases 3 were so-called "precipitate labors" and 6 were premature infants.

In the series of operative deliveries there were six versions, and extractions, 10 breech extractions, and 29 forceps deliveries, the latter being about twice as numerous as the two former combined. This greater preponderance of cerebral hemorrhages following forceps deliveries can be explained by the greater frequency of forceps operations and further by considering the possibility of a cerebral hemorrhage when forceps are applied. With the application of the blades the longitudinal diameter of the skull is increased and there is also a compensatory shortening of the transverse diameter with undue tension on the falx cerebri and tentorium cerebelli thus producing a tear of the tentorium, the adjacent sinuses and the veins of Galen. Prolonged or difficult traction with forceps increases this danger. Likewise, a sudden traction, as in a breech or breech following version, produces a similar effect frequently resulting in hemorrhage.

In rapid spontaneous deliveries, the sudden stress upon the fetal head produced by the forces of labor may similarly produce a hemorrhage. In premature fetuses, where the blood vessels are very delicate, cerebral hemorrhage may easily occur following rapid spontaneous labors, operative deliveries, or even prolonged slow labors.

Another organ which may be the seat of severe hemorrhage sufficient to produce death is the adrenal body. There were five such cases, two of which occurred in spontaneous deliveries. There were also eight cases (2.5 per cent) of so-called hemorrhagic diathesis of the newborn. These were all associated with prolonged bleeding and coagulation times. At autopsy there were general diffuse hemorrhages into all the internal organs. In two such cases in addition to the hemorrhagic disease there was a marked jaundice, both infants being born to the same mother within one year. These were cases of non-syphilitic familial jaundice.

There is still another group of cases to which the terms intra-uterine asphyxia and asphyxia neonatorum have frequently been given as the cause of death. In our series there were 66 (20.6 per cent) of such cases for which no other explanation than that of

atelectasis pulmonum could be found. Of these, 48 were prematures in spontaneous deliveries, five were full-term babies in normal deliveries, and 13 viable babies following cesarean section. Of the latter, one might possibly have been due to an enlarged thymus gland, the organ weighing 28 grams. Aside from prematurity, particularly in those cases associated with maternal toxemia or nephritis where labor was induced without much hope of survival of the infant the only other possible causes of death excluding trauma and deformities were the toxemia with its resultant effect upon the infant or morphine which had been previously administered to the mother. It is interesting to note that babies delivered by cesarean section and not subjected to forced delivery per vias naturales may die of asphyxia.

There were 13 cases (4.06 per cent) of monsters including anencephalus, hydrocephalus and associated spina bifida and one case of iniencephalus. In addition, there were two cases of diaphragmatic hernia, three cases of deformities of the urogenital apparatus, one a complete absence of kidneys, ureters, and urinary bladder, and two with only one kidney. Of the 13 cases of monsters, seven were associated with placental pathology, one an abruptio placentae, and six with either frank placenta previa or low insertion of the placenta. It has been shown by Greenhill that there is a definite relationship between fetal monstrosities or deformities and placenta previa.

There were four (1.3 per cent) of so-called "pituitrin deaths," three of which occurred in the "courtesy service." The low incidence of such cases in our service is due to the fact that pituitrin is forbidden during the second stage of labor. At postmortem a "pituitrin head" is characterized by a marked congestion of the vessels of the pia mater with no other outstanding pathology. This marked congestion is probably the result of sudden tetanic uterine contractions.

Syphilis does not seem to occupy a prominent place among the causes of death in the newborn in this series. There were only seven cases (2.6 per cent) in which the postmortem diagnosis of syphilis could be made without question, such as x-ray of the infant which showed syphilitic epiphysitis of the long bones and positive Wassermann reactions of the mother and in some instances on both parents. There was one case of pneumonia alba and one case of syphilitic pemphigus. In only one instance could spirochetes be recovered from the tissues stained and examined by the Levaditi method.

There were two cases of neonatal infection, one a generalized streptococcus peritonitis which had its origin in the umbilical cord stump; another (one of twins) with a possible septic sore throat. Of medical interest, there were four cases of pneumonia (three bronchopneumonia and one lobar pneumonia). In two of these cases, lanugo and meconium could be expressed from the bronchi; these latter cases were probably cases of aspiration pneumonia.

## COMMENT

Every effort should be made to obtain fetal postmortem examinations. They are instructive from the obstetrician's point of view as well as of pathologic interest. Cerebral hemorrhage as a result of difficult operative deliveries, while still of a high incidence, has been reduced in the larger maternities. With improved prenatal care as in the treatment of syphilis during pregnancy much can be done to insure the birth of a normal child. There is still much to be desired in asepsis as under the most modern and improved technic infection still occurs.

## SUMMARY

1. In a series of 320 fetal autopsies there were 213 infant deaths and 107 stillbirths, 60 intranatal, and 47 before labor set in with maceration of the fetus.

2. There were 45 cases of intracranial hemorrhages in operative deliveries and 18 in spontaneous deliveries.

3. In 66 cases of asphyxia of the newborn with a diagnosis of atelectasis pulmonum, 48 babies were premature, five were full-term spontaneous, and 13 were delivered by cesarean section, one with an enlarged thymus.

4. There were 13 monsters, seven of which were associated with placental pathology and in addition, three with deformities of the urogenital apparatus, and two with diaphragmatic hernia.

5. There were two cases of sepsis of the newborn and four cases of pneumonia.

122 SOUTH MICHIGAN AVENUE.

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Wesseling: *The March Peak in Birth Curves*. *Nederlandsch Maandschrift voor Geneeskunde*, 1924, xii, 248.

In Holland more babies are born in March than in any other month of the year. A similar condition exists in practically all other countries, though the actual time varies somewhat, it being a month or two earlier in countries nearer the equator, e.g., Greece and Italy.

The author compares animals that have estrus once or twice yearly, with woman who menstruates every month, the only seasonal exception being among some Esquimaux who menstruate only during the summer. As to the real cause for this seasonal variation in fertility in man, Wesseling admits there can be no certainty, but he ventures the suggestion that, since it has been demonstrated that sterility may be produced by the withholding of certain vitamins from experimental animals, the increased fertility in early summer may be due to food factors,

R. E. WOBUS,

# CHRONIC ENDOTRACHELITIS\*

## A PREOPERATIVE AND POSTOPERATIVE STUDY

BY FRANCIS W. SOVAK, M.D., F.A.C.S., NEW YORK

(From the Department of Gynecology, New York University and Bellevue Hospital Medical College)

A STUDY of medical literature concerning various methods of treatment of chronic endotrachelitis reveals, in many instances, a lack of consideration of the end-results in a sufficient number of cases over a definite length of time after operation.

With this in view, I wish to present a short preoperative study of 229 consecutive cases, giving the operative treatment for chronic endotrachelitis as followed on the gynecologic service at Bellevue Hospital, and the end-results from two to three years after operation in 107 cases. These cases were selected from a total of 511 cases operated upon in the period 1920 to 1924. I will present the subject from the standpoint of age, pregnancies and abortions, laceration of the cervix, leucorrhea, associated pelvic pathology, associated operations, the cure of leucorrhea, conception and labor after operation and illustrations of the type of operation performed in this series of cases.

*Age.*—The greatest percentage of cases, 85.4 per cent, occurred between the ages of twenty and forty years. It is in this period of active sexual life that gonorrhea, and trauma and infection, incident to childbirth and abortion, play such a prominent rôle in the etiology of this condition. After the age of forty there is a marked drop in the number of cases.

*Pregnancies and Abortions.*—Of 229 cases, 160, or 69.8 per cent, gave a history of one or more normal deliveries and 78, or 44 per cent, of having one or more induced abortions. The above figures show that childbirth and abortion are great factors in the etiology of chronic endotrachelitis. We have admitted to our wards an average of 600 abortions a year, and the type of patient we treat rarely gives a history of spontaneous abortion. As an illustration, one of the above cases gave a history of abortion having been induced seventeen times.

*Laceration of the Cervix.*—Some type of laceration of the cervix, unilateral, bilateral or stellate was evident in 165 cases, or 72 per cent. Three of this number had a cervical polyp present in addition to the laceration.

*Leucorrhea.*—Leucorrhea was a prominent symptom in this series of cases. Of 161 cases, a vaginal discharge, mucoid or mucopurulent in character, either moderate or profuse was present in 128, or 79.5 per cent. The average duration of the leucorrhea was 24.2 months before operation.

\*Read at a meeting of the New York Obstetrical Society, November 8, 1927.

*Associated Pelvic and Vaginal Pathology.*—Endotrachelitis seldom exists alone. There is an associated uterine retrodisplacement in a majority of these cases of chronic cervical infection. This condition was noted in 165 cases, or 72.3 per cent. On the other hand, contrary to expectations, but 27, or 11.7 per cent, of our cases had adnexal disease. Of the above 27 cases, 4, or 1.7 per cent, had adnexal pathology existing alone, the remaining number being associated with uterine displacement.

As these cases of chronic endotrachelitis complained of a leucorrhea of an average duration of 24.2 months, some form of home or dispensary treatment may have been followed during this period for the relief of the discharge, thus aiding resolution and repair of any pelvic inflammation. This fact may explain the small percentage with adnexal pathology encountered in this series.

A lacerated perineum was evident in 141, or 61.8 per cent, of the cases. In but 17 of our cases (7.4 per cent) endotrachelitis was the only existing pathology and in which a tracheloplasty was the only operative procedure.

*Associated Operations.*—Uterine suspension was performed in 72.3 per cent of the cases; some type of adnexal operation was done in 11.7 per cent of the cases and 61.8 per cent had a perineorrhaphy. Seventeen cases, or 7.4 per cent, had only a tracheloplasty performed; this being the only operative procedure.

*Type of Operation.*—The operative technic as followed at Bellevue Hospital is based upon the coning operation as devised by Sturmdorf. The method of coning out the infected cervical tissue and the making and suturing of the cervical cuff are somewhat modified.

*Cure of Leucorrhea.*—Of the 107 cases studied postoperatively, reports as to the cure of the leucorrhea were received in 75. A cure of the vaginal discharge was reported in 66 cases, or 88 per cent. Four cases reported as having been improved and five cases continued to have a profuse discharge. Failure of a cure in these cases was probably due to an inadequate removal of the infected cervical tissue; i.e., not carrying the apex of the cone up to near the region of the internal os. This is an important point for the success of this operative procedure.

*Conception and Nonconception After Operation.*—Conception, following an average lapse of time of 12.5 months after operation, occurred in 37 of the cases. Of these, 27, or 72.9 per cent, delivered viable children, and in but two of these cases was there any difficulty during labor. Both required section; one for a contracted pelvis and the other for cervical dystocia. Of the remaining 10 cases, three, or 8.1 per cent, aborted spontaneously in the fourth month of their pregnancies and seven cases gave a history of being aborted (induced) after the pregnancy had progressed for an average period of 2.5 months.

It may be of interest to state that 15, 40.5 per cent, of the cases con-



ceiving, were never pregnant before operation and that five cases had some type of operation for adnexal pathology in addition to the tracheloplasty. The number of cases not conceiving after operation was 70. A detailed study of these discloses the following: contraceptive measures such as the use of cervical buttons, condoms, etc., were practiced by 29 women; sterilized previous to present operation, one case; menopause at time of operation (average age, 46.5 years), 16 cases; single or widowed, 5 cases. It is evident from the above figures that pregnancy was improbable in 51 of the 70 nonconceiving cases, leaving 19 as the actual number of cases failing to conceive after operation in this series. Therefore, 66 per cent of pregnancies occurred in women who could possibly conceive following operation.

Pregnancy, however, may occur following any type of operation on the cervix but the actual determination of its success is based, other than that of the cure of leucorrhea, upon the number of cases delivering viable babies.

*Postoperative Hemorrhage.*—During the period 1920-1924 from which this series of cases was taken for study, a total of 511 tracheloplastic operations was performed. Postoperative hemorrhage occurred on an average of eleven days after operation in three cases, or 0.5 per cent. This may have been caused by a faulty tying of the hemostatic ligature or by a possible early absorption of the ligature material.

#### CONCLUSIONS

1. The greatest percentage of cases of endotrachelitis occurs between the ages of twenty and forty years, the period of active sexual life.

2. Pregnancy and abortion apparently are the most definite factors in the etiology of endotrachelitis.

3. Leucorrhea was the most prominent single symptom.

4. A large number of cases had associated pelvic pathology. The most common associated factor was retroversion of the uterus. Inflammatory adnexal disease, contrary to expectation occurred in but a small percentage of the cases.

5. A large percentage of the cases had associated pathology requiring operation, and in but 17 cases tracheloplasty was the only operation performed.

6. Leucorrhea was cured by tracheloplasty in 88 per cent of the cases.

7. Following tracheloplasty, 66 per cent of patients in whom pregnancy was possible, became pregnant.

8. Following tracheloplasty, 72 per cent of patients conceiving, delivered viable children.

9. Postoperative hemorrhage was a minor factor occurring in but 0.5 per cent of the cases.

## THE OBSTETRIC INCLINOMETER\*

### A NEW INSTRUMENT FOR MEASURING THE ANGULATION OF THE FEMALE PELVIC PLANES

BY J. BAY JACOBS, M.D., WASHINGTON, D. C.

(From the Department of Obstetrics, Georgetown University School of Medicine)

THE term *inclination* is seldom used in obstetric practice. Failure to determine pelvic inclination is probably due to the fact that most obstetricians are not familiar with any method of measuring pelvic angles and, furthermore, to the lack of a practical instrument to furnish this information directly or otherwise.

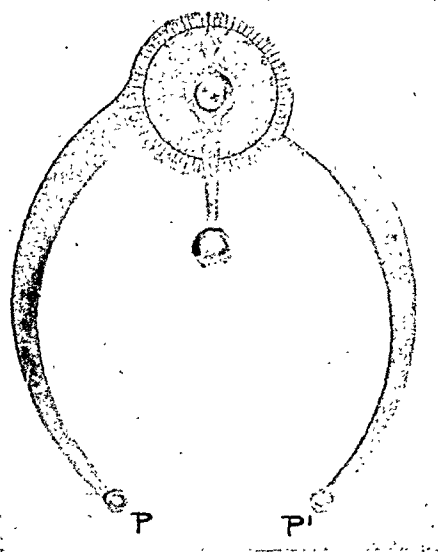


Fig. 1.—The calipers, weighted pendulum, and graduated disc.

Neumann and Ehrenfest<sup>1</sup> in 1900 devised the kliseometer for making a graphic study of the pelvis. Ehrenfest<sup>2</sup> in 1903 perfected the pelvigram for the same purpose. Both of these contrivances are large, composed of many parts, and require an assistant; also a draft board must be attached in a vertical position to the foot end of the table. Although the accuracy of the determinations cannot be doubted, the routine use of such an instrument even in border-line cases is time-consuming and almost impractical in the average case.

Dougal<sup>3</sup> in 1913 devised a pelvigram for recording a diagrammatic cross-section of the pelvis. Though simple in construction, Dougal's instrument is bulky and hardly portable. Furthermore, there is no freedom of motion, since the instrument rests on a stand.

Gaszyński<sup>4</sup> in 1904 described an instrument for measuring the height of the symphysis, the length of the diagonal conjugate and the relation of the inclination

\*Read and demonstrated before the Medical Society of the District of Columbia, April 27, 1927.

between the two. From these findings the length of the true conjugate may be estimated, but it requires a difficult mathematical procedure.

In my review of the literature the instruments already described represent the only ones I could find that give information regarding pelvic inclination. All others were devised to determine linear measurements alone.

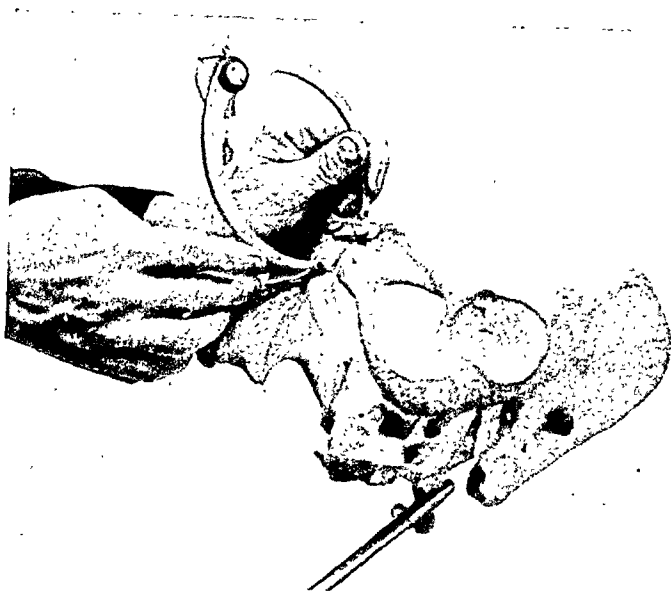


Fig. 2.—Measuring the height and inclination of the symphysis pubis.

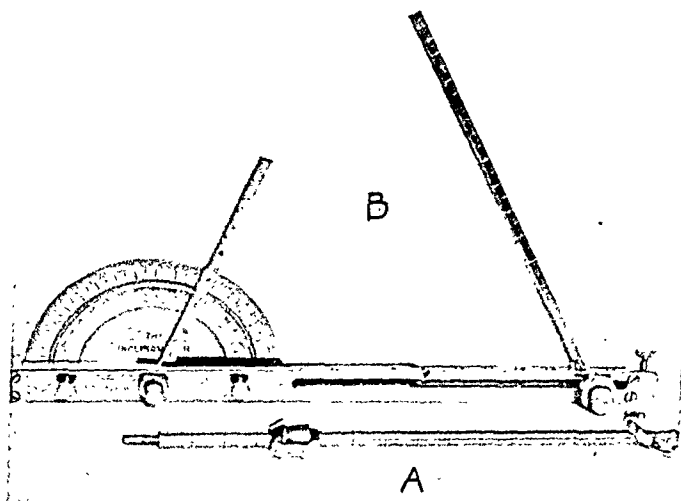


Fig. 3.—Measuring rod and calculating mechanism.

The obstetric inclinometer which I desire to present herewith, consists of several parts. Fig. 1 shows a modified pair of calipers with a weighted pendulum attached to the anterior surface. This pendulum is so constructed as to eliminate friction between it and the graduated disc over which it slides. When the calipers are held in the upright position, the indicator records the angle of the plane in which

the points P and P' lie. The distance between P and P' is read in centimeters on the posterior surface of the disc. To determine the height and inclination of the symphysis, the calipers are applied to the symphysis pubis as in Fig. 2, the height of the symphysis measured by the small indicator and the inclination of the plane of the pubic bone recorded by the swing of the pendulum on the opposite side.

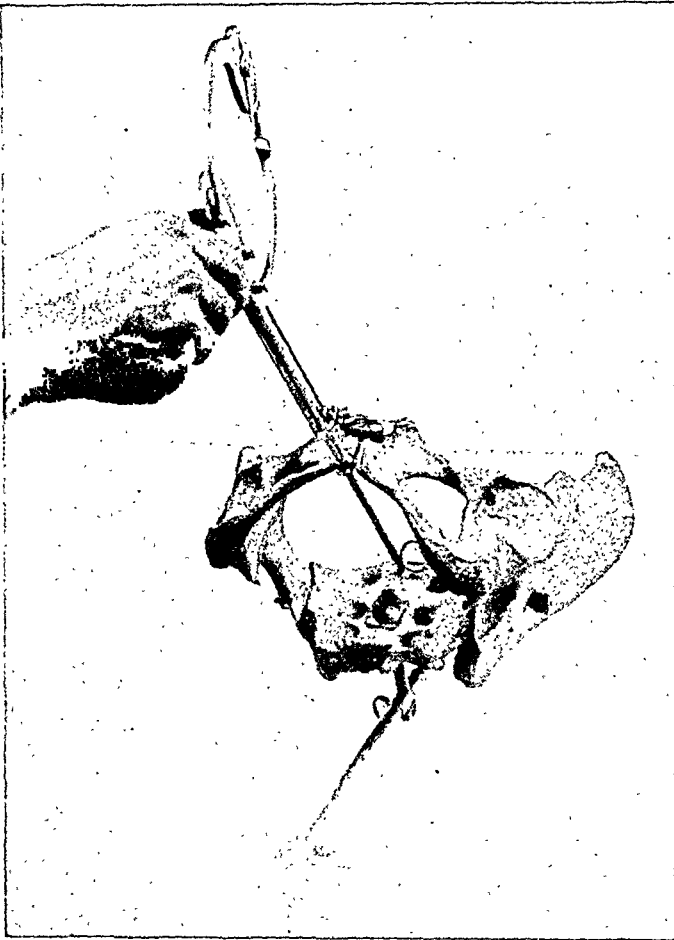


Fig. 4.—Measuring the diagonal conjugate diameter and the inclination of the plane in which it lies.

Fig. 3 shows a measuring rod (A) 15 cm. long, which may be connected with the calculating mechanism (B).

To measure the diagonal conjugate insert the terminal phalanx of the middle finger into the ring on the rod A (Fig. 3) and place the ball end on the edge of the promontory. Then bring the sliding spool on the rod in contact with the lower border of the symphysis and read off the length of the diagonal conjugate (see Fig. 4).

For estimating the inclination of the diagonal conjugate, part A is attached to part B as shown in Fig. 4, and the instrument is held at

the two extremities of the diagonal conjugate. The swing of the pendulum on the attached calipers indicates the inclination of the diameter.

To determine the length of the true conjugate, adjust the short arm over the face of the protractor so as to subtend an angle which corresponds to that between the diagonal conjugate and the symphysis. Adjust the long arm by shifting it along the slot until it is at a figure which represents the length of the diagonal conjugate. Cross the long arm over the short arm until the long arm is over the

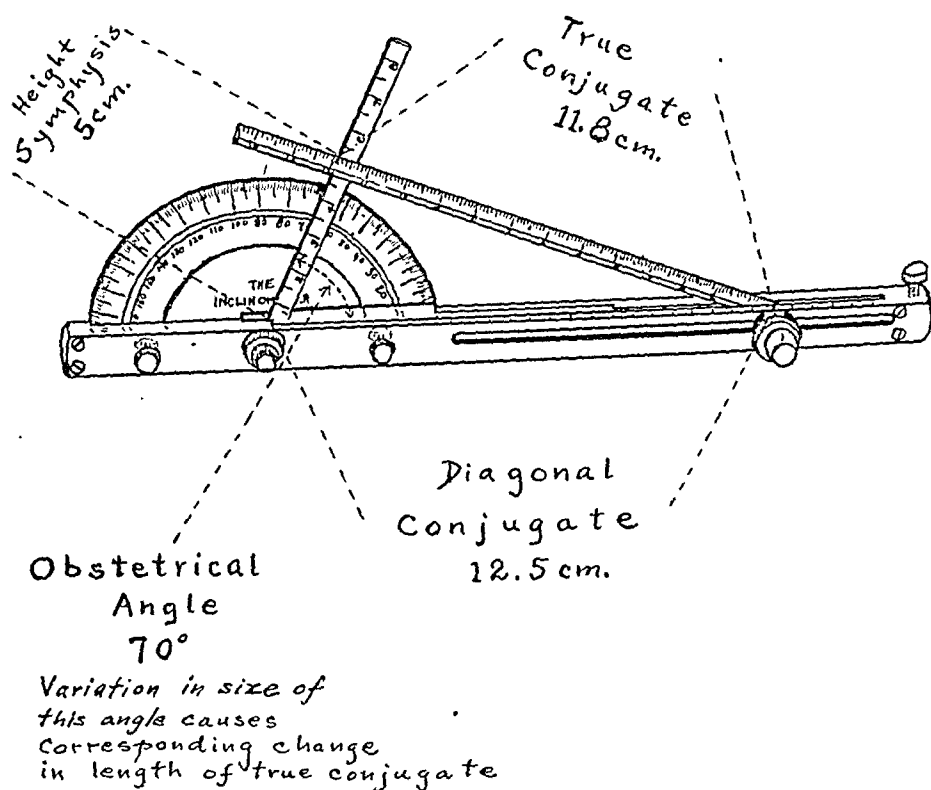


Fig. 5.—Showing construction of obstetric triangle and determination of true conjugate diameter.

figure which represents the length of the symphysis. The reading on the long arm at the intersection is the length of the true conjugate. (See Fig. 5.)

With this instrument the anteroposterior diameter of the outlet and the inclination of it may be easily determined. The caliper may be used in determining the bisischial diameter. A supplementary adjustment, which is in the process of manufacture, renders easy the determination of the posterior sagittal diameter.

By inclination of the pelvis is generally meant the angle of inclination of the plane of the inlet. This is determined by constructing a pelvigram (see Fig. 6). In this illustration figures do not correspond to those given in the text, because the patient is in the prone rather

than the erect position. If allowance be made for this alteration, the corresponding determinations can easily be obtained in the vertical position.

## SUMMARY

1. The "inclinometer" is a mechanical device by which the obstetric diameters, the inclination of the pelvis as a whole and the angulation of the various planes may be read directly on the instrument and with great precision.

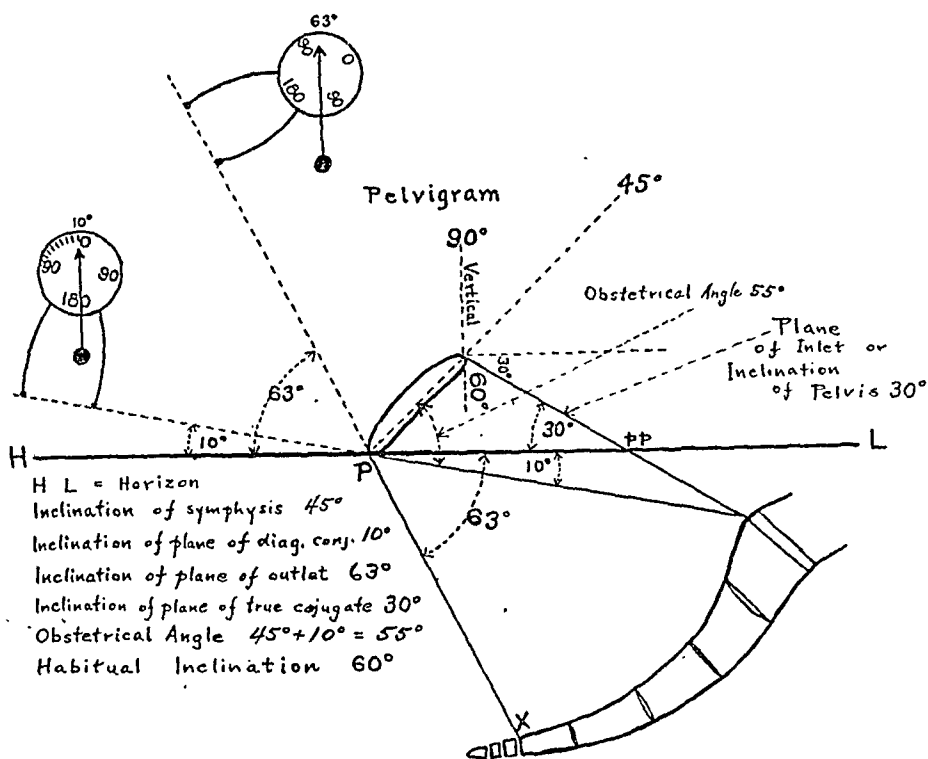


Fig. 6.—A sample pelvigram.

2. The instrument is small, portable and practical for everyday use.
3. Its application does not require an assistant and it may be properly sterilized.
4. By means of the inclinometer we may visualize the interior of the pelvis in the form of the *obstetric triangle*, which is formed by the symphysis pubis, the diagonal and the true conjugate.
5. Studies with the inclinometer indicate that our ordinary method of computing the true from the diagonal conjugate has frequently caused an underestimate of the degree of pelvic contraction.
6. In some instances, what appears to be a borderline case proves to be one of absolutely contracted pelvis when studied with the aid of the obstetric inclinometer.

I wish to express my gratitude to Dr. John F. Moran, Professor of Obstetrics at Georgetown University, and Dr. A. Y. P. Garnett, Associate Professor, for their kindly criticism and suggestions.

I am indebted to the Rev. Francis A. Tondorf, S. J., Director of the Seismic Observatory of Georgetown University, who gave generously of his time in determining the mathematical accuracy of this instrument.

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THE CHASTLETON HOTEL.

## REPORT OF TWO CASES OF PARTIAL HYDATIDIFORM DEGENERATION OF THE PLACENTA LATE IN PREGNANCY

BY EDWARD ALLEN, M.D., CHICAGO, ILL.

(*From the Obstetrical Department of Presbyterian Hospital, Chicago, and Rush Medical College*)

**H**YDATIDIFORM degeneration of the placenta is a very common condition in early pregnancy. Meyer\* in his work on the specimens in the Mall collection was able to demonstrate molar degeneration in 42.3 per cent of the placentas in the extrauterine pregnancy specimens and 32.4 per cent in the uterine abortuses. He calculates from his findings that at least 10 per cent of all conceptions end in hydatid degeneration. This makes it probably the most common disease of the placenta and fetus in the early months of gestation.

As pregnancy approaches term, these changes in the chorionic villi become progressively more uncommon until at term it becomes a rare disease. It has been estimated by different investigators that a well-developed hydatid mole occurs once in each 300 to 2000 pregnancies. These estimates include all the instances of well-advanced molar degeneration in which there was no macroscopic evidence of the fetus. The cases reported in which a well-developed fetus was present are quite unusual. Findley,† in the series of 210 cases that he collected from the literature in 1903, mentions a case report by Potu, of a patient with a generalized hydatidiform degeneration of the placenta and a normal fetus who was delivered at term.

During the past three years I have had the opportunity to deliver two patients, one seven and a half months pregnant, the other at approximately eight months, whose placenta revealed definite evidence

\*Meyer, A. W.: *Contrib. to Embryology*, 1921, xii, 1-369.

†Findley, Palmer: *Am. Jour. Med. Sc.*, 1903, cxxv, 486-519.

of hydatid changes and a marked edema of the fetus. That these changes are not just a generalized dropsy or the result of macerative changes will be shown later, in the description of the tissues studied in microscopic section.

The case histories of both patients, and the gross microscopic pathologic findings of the placentae and babies are quite interesting and, I think, merit a rather detailed report.

CASE 1.—Mrs. H., a primipara, aged twenty. Her menstrual history had been regular. The last regular menstrual period was September 20, 1924. Pregnancy had been uneventful except rather severe nausea during the first trimester. At this time, March 31, 1925, when I first saw her, the patient had developed a marked generalized edema. There was a constant severe headache and some shortness of

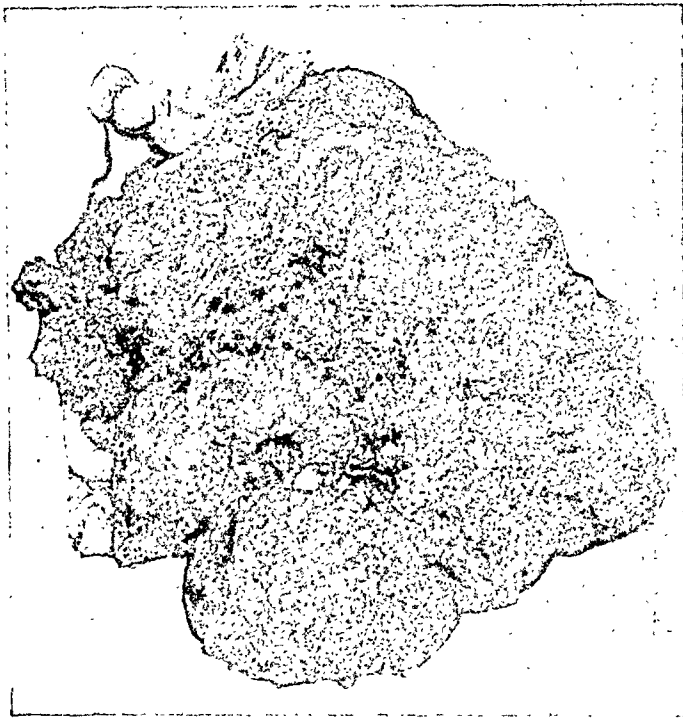


Fig. 1.—Case 1. Placenta showing minute vesicle formation on the maternal surface.

breath. She complained of severe pain in the abdomen which seemed localized over the uterus and was aggravated by palpation. The uterus was larger than the period of amenorrhea would suggest. The fundus extended to within two fingers' breadth of the xiphoid process. Due to the pain produced on palpation of the uterus, the position of the fetus could not be determined definitely. The x-ray showed a breech presentation. The heart tones were 132 on the right side of the abdomen.

The blood pressure during the time of observation ranged around 130 systolic, 70 diastolic; the blood count revealed 80 per cent hemoglobin, 3,950,000 erythrocytes, and 9,900 white cells. The urine gave a 2 mm. ring of albumin to the metric acid test and contained many hyaline and a few granular casts.

The condition of the patient did not improve with rest in bed, catharsis, limitation of diet, etc., and during the night of April 5, 1925, the heart tones ceased. Labor was induced with castor oil and quinine on April 6, 1925, and after sixteen and one-



half hours a stillborn macerated fetus was delivered in the right sacrum anterior position. The fetus was markedly edematous, and the abdomen was distended with fluid. Permission for postmortem could not be obtained. The placenta was about twice as thick as normal and presented many small vesicles scattered over its surface. Microscopic sections taken from several places revealed a well-developed hydatid degeneration of many of the villi.

*Microscopic Description.*—The villi were several times larger than normal chorionic villi. Vacuolization in various stages was present in the stromal cells; in many only a few cells were left, and the villus was represented by a ring of well-preserved epithelial cells. There did not seem to be any abnormal proliferation of



• Fig. 2.—Case 1. Section of placenta showing hydatid degeneration.

the syncytial cells. Few villi carried blood vessels. Those in the larger branches seemed distended with blood. The patient was curetted six weeks later, but no evidence of fetal cells remained, and she had no further difficulty.

**CASE 2.**—Mrs. L. This patient was also a primipara. The menstrual history was normal. Last regular period was March 13, 1926. Pregnancy had been normal. I saw her for the first time when she entered the hospital November 2, 1926, having a few irregular pains. The blood pressure was 126 systolic, 74 diastolic. The urine contained a trace of albumin but no sugar. The blood count showed only 11,200 leucocytes; hemoglobin was 80 per cent. The blood Wassermann was negative. The membranes had ruptured five hours previously. Labor progressed rapidly and normally until the head reached the perineum after seven hours. It remained in this position for one hour and Kielland forceps were applied. The head delivered easily, but considerable difficulty was experienced with the rest of the body, due to a marked

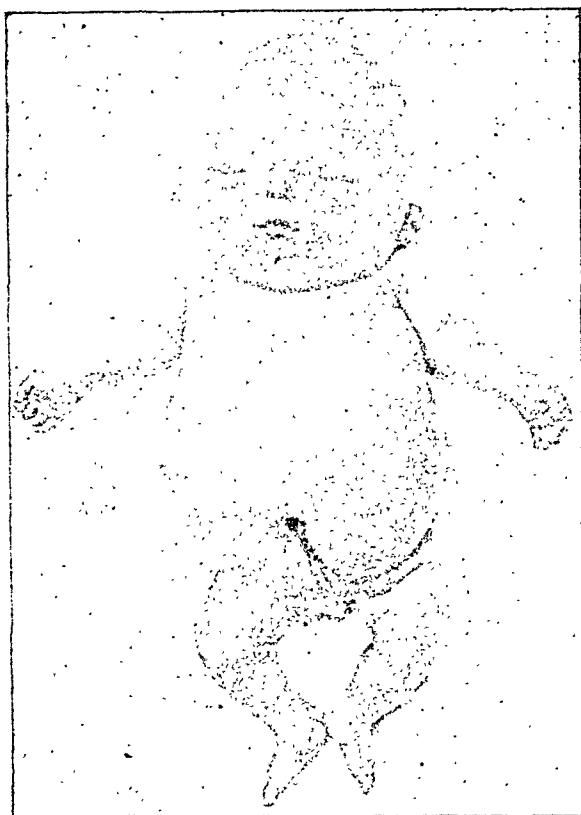


Fig. 3.—Case 2. The edema was generalized in this fetus, but the marked collection in the abdominal cavity is well shown.

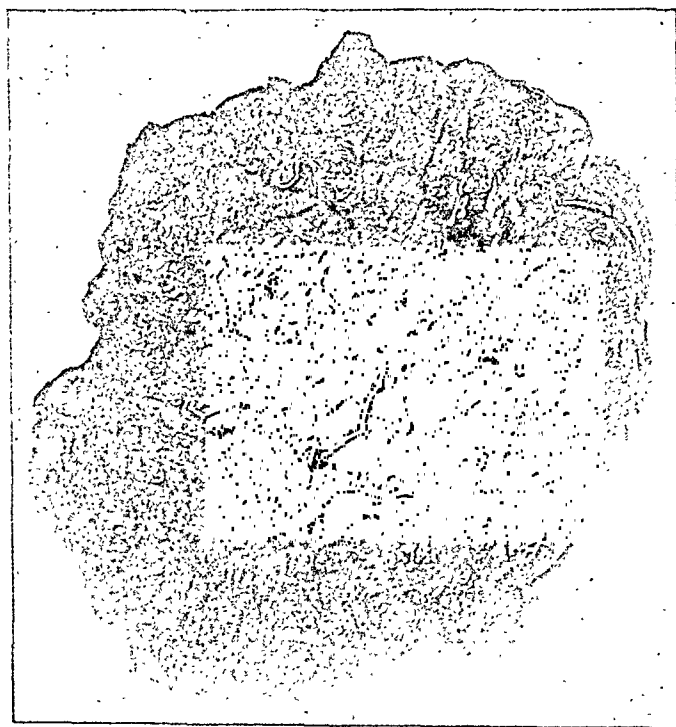


Fig. 4.—Case 2. Placenta described from second case. Vesicles not so well shown but quite as evident in the fresh specimen as in Case 1.

distension of the abdomen, with fluid. The anasarca seemed to be localized below the costal margin. The infant survived only fifteen minutes. No efforts were made to prolong its life.

The placenta delivered normally with about 300 to 400 c.c. of blood. It was about three times as thick as a normal placenta and seemed to crepitate like lung tissue. Many minute vesicles were scattered over its surface.

*Microscopic Description.*—The villi were several times larger in size than normal. There was a marked edema and vacuolization of the stroma. Only a few showed definite cystic changes. Canalization was present in the majority of the villi and



Fig. 5.—Case 2. Microscopic section of placenta demonstrating marked vacuolization of stromal cells. Also proliferation of epithelial elements.

there was a well-preserved epithelial covering. There were areas of rather marked syncytial proliferation and several small infarcted areas.

On postmortem examination the ascites was the most noteworthy change found. About 400 c.c. of clear straw-colored fluid was collected from the abdominal cavity. Each of the pleural cavities and the pericardial sac contained approximately 5 c.c. of fluid. Edema of the tissues and engorgement of the blood vessels with blood cells were noted everywhere. Myeloid degeneration was quite marked in microscopic section, especially in the liver.

# INTERSTITIAL TUBAL PREGNANCY, WITH THE REPORT OF A CASE\*

BY SALVATORE DI PALMA, M.D., F.A.C.S., NEW YORK, N. Y.

RECENT statistics show that interstitial tubal pregnancy is not as uncommon as we were formerly led to believe. Lately more detailed cases are reported in the literature, most of them being well authenticated by pathologic proofs. Gonorrhea and puerperal infections are usually given as the causative factors for narrowing of the tubal lumen. While gonorrhea is the cause in some cases, I believe the chief etiologic factor is the narrowing of the lumen of the tube from postpartum and postabortal infections. Gonococcal infections in the fallopian tubes tend, in most instances, to close the tubes permanently. In the Gynecological Ward of the Harlem Hospital, where over 75 per cent of the cases operated upon in colored patients are for adnexal disease of gonorrheal origin, the occurrence of ectopic pregnancy in negroes is very small, over 90 per cent occurring in white patients. In the majority of cases of extrauterine pregnancy operated in the hospital named above, the history and physical findings do not lead to the belief that the gonococcus might have been the principal factor in previous inflammations. In most cases of interstitial pregnancies reported since 1918 the history of previous labors or abortions was present. In a case of interstitial pregnancy previously reported by the writer as well as in a case herein described, the tubal lumen was proved patent and normal in its entrance into the uterus. This tends to show that a low grade infection of the interstitial portion of the tube would account for narrowing of the tubal lumen at this site to such an extent as to prevent passage of the fertilized ovum.

Noninflammatory mechanical obstruction as the cause of either interstitial or other varieties of tubal pregnancy, from the small number of reported cases would seem to be, indeed, very rare. The possibility of such cause must, however, be admitted. The same statements apply to congenital adnexal malformation.

The course of interstitial pregnancy depends on: (1) the site of implantation to the interstitial lumen; (2) the proximity, number and size of blood vessels to the site of nidation.

From the anatomic formation of the uterine cornu, it is a physical impossibility for a true interstitial pregnancy to go to term as such. If the attachment has occurred in the outer third of the interstitial

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\*Read before the Section of Obstetrics and Gynecology, New York Academy of Medicine, February 23, 1926.

portion, there is usually an early rupture; if nidation has taken place in the middle portion, a later rupture with a larger sac occurs; and, if the attachment is situated in the inner third of the interstitial tubal lumen, there takes place either an abortion in the uterine cavity or a still later rupture and a still larger sac. In each instance the amount of hemorrhage depends on the number and size of nearby blood vessels that suffer erosion.

The diagnosis practically is never made in the early cases before rupture occurs. Usually the patient presents the classic picture of a ruptured extrauterine pregnancy with intraperitoneal hemorrhage, and a laparotomy discloses the anatomic diagnosis. I believe that the gravity of the prognosis of this condition has been overestimated. That statistics do show a large mortality is undeniable. I am of the opinion, however, that such mortality is due to two causes: (1) to the unnecessary radical operations performed; (2) to postoperative sepsis; and not, as a rule, to the hemorrhage which most writers emphasize as the responsible factor. A point which I wish to stress in an interstitial pregnancy is that the less done the better the prognosis, and that with the exception of the cases where the pregnancy has advanced to the third or fourth month, resection of the offending cornu is usually sufficient.

Since the author adopted the procedure of giving a transfusion or a saline infusion in ruptured extrauterine pregnancy just as the operation is begun, and of leaving all fluid blood in the peritoneal cavity, postoperative results have been most gratifying both as to mortality and to morbidity.

**CASE REPORT.**—B. S., white, admitted to the Harlem Hospital, May 3, 1925, discharged May 17, 1925.

**Chief Complaint.**—Pain in abdomen, pains in shoulder blades, hot flashes and cold sweats, nausea, vertigo.

**Present Illness.**—At 9 A.M. patient was seized with sudden knife-like pains in both lower quadrants. Together with these pains she had hot flashes followed by cold sweats. Although she did not faint nor vomit, she felt inclined to do both. In the afternoon she developed pain in both shoulder blades, pain becoming greater in right side. Patient has never had similar attack. Last period was on March 14, about 6 weeks previous to her administration. No bleeding since. Married 6 years, para i, gravida ii, last pregnancy 15 months ago, both children delivered normally, last child fed 5 months on breast.

The patient had rapid pulse and respiration. Mucous membranes pale color. Milky secretion present. Abdomen slightly distended, marked tenderness throughout, particularly in the right lower quadrant. No masses felt, moderate amount of rigidity. Cullen's sign not present. External genitals, normal. Vagina, negative. Perineum, intact, not relaxed. Cervix, negative. Marked tenderness in both fornices, no masses felt. Culdesac, negative. Motion of cervix very painful.

**Diagnosis.**—Ruptured ectopic (Right).

Operation a few hours after admission. Right paramedian incision; abdominal cavity filled with fluid and clotted blood. At the right cornu between and be-

yond the round ligament and uteroovarian ligament the uterus was ruptured and a small cauliflower mass protruded, with active bleeding. This mass was knobby in appearance and size about  $2 \times 1\frac{1}{2}$  cm. Below the rupture on this mass the fallopian tube was seen apparently not enlarged. The mass was removed and the uterine wound was closed in layers. The tubes were not removed; all large clots of blood were removed from the abdominal cavity but the fluid blood was left in. Abdominal wound closed in layers, 900 c.c. saline (normal) solution with 15 drops of adrenalin were given to the patient intravenously. Postoperative diagnosis: right ruptured interstitial pregnancy confirmed by histologic examination.

Patient made an uneventful recovery.

1103 PARK AVENUE.

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## DOUBLE VAGINA AS A CAUSE OF STERILITY\*

### WITH CASE REPORT

BY SAMUEL L. SIEGLER, M.D., BROOKLYN, N. Y.

**D**DOUBLE vagina, in the literal sense, can only be said to exist in certain monstrosities, such as pygopagus twins, but it has become customary to apply the term to cases in which the two müllerian ducts, which normally fuse into one canal, have remained separate, the residual septum persisting along a part or the entire extent of its vaginal course.

The following case is of interest in that the septum which divided this vagina in its entire course formed two canals, the left half of which ended in a blind pouch while the right half, which was one-third the width of the left was patent, communicating with the cervix.

Mrs. S. G., white, aged twenty-one years, married, first consulted me at my office on March 8, 1925, to find out why she had never been pregnant. Her family history was irrelevant. Catamenia first appeared at the age of fourteen, every 4 to 5 weeks, three-day type with a copious flow and no dysmenorrhea. Her last menstrual period was on February 15, 1925. She was married two years, no children, miscarriages, nor abortions. Her husband was examined three months ago and was found to be in good health.

Examination on March 8th, showed a female of short stature. There was apparently a normal nulliparous vagina, which measured about 8 cm. in length and about 3 cm. in width. The examining fingers met some resistance at the distal end of the canal. The cervix could not be felt. Investigating a slight irregularity at the side of the vaginal entrance, I found a slit-like opening leading into a second canal, which was at this time collapsed but through which the tip of the cervix could be felt. Uterus and adnexa could not be palpated at this time. Mr. and Mrs. G. were both told of this abnormality and were instructed as to the correct method of approach in their future conjugal relations and were told to report in two months. It is interesting to note in passing that neither were aware of the fact that their cohabitation was misplaced. This was a natural, unintentional, congenital contraception measure.

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\*Read at a meeting of the East New York Medical Society, February 24, 1927.

On July 8, four months later, the woman again presented herself, giving May 11 as her last menstrual period, with a history of morning sickness and painful breasts. Vaginal examination at this time showed left vaginal canal with the same measurements, but imperforate at its proximal end; right, which was collapsed now admitted two fingers, but with difficulty; cervix soft, uterus dextroverted, soft, enlarged to about six weeks' gravidity. Right adnexa not palpated, left ovary cystic, tender, and prolapsed. Her subsequent antepartum record was normal, with normal blood pressure and urinalysis. Date of expectancy was February 15, 1926.

Mrs. S. G. entered the Brooklyn Hebrew Maternity Hospital in labor on February 16, with ruptured membranes since February 14 and a temperature on admission of 101° F. The first stage of labor was not complete until forty-eight hours after admission. Forceps were applied after the septum, which was in this case an impediment in the passage, was excised and the stumps sutured with a running chromic suture. The infant weighed 5 pounds and 8 ounces. Mrs. G. and the baby left the hospital on the fourteenth day in good condition.

536 SARATOGA AVENUE.

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## REPORT OF A CASE OF TORSION OF A HYDROSALPINX

BY TORLEIF TORLAND, M.D., F.A.C.S., SEATTLE, WASHINGTON

ACCORDING to Eastman\* there are only ninety-one cases of this condition on record. The occurrence, therefore, seems rare enough to warrant further case reports.

My case is that of a forty-one year old white patient whom I first saw August 31, 1927. Her menstrual history was normal. She had one miscarriage about twenty years ago, but no children. For the last two years she has been complaining of an indefinite, tired feeling in the lower abdomen, but otherwise has been well. She has never had an operation. She denies venereal diseases.

August thirty-first, on admission to the hospital, she was suddenly taken ill with a severe, excruciating pain in the right lumbar region radiating downward on the right abdominal side. She vomited several times. Her condition rapidly became worse, pain continuous and increasing in severity, stabbing in character, so severe that she was screaming in agony. There was some relief when she exerted a firm manual pressure over the right kidney region. The pain persisted and seemed to radiate gradually more downward to the right iliac fossa and to the groin and labia. There was frequency of urination, but no burning or pain. At this time she noticed that the regular menstrual flow had started.

I first saw her about five hours after the onset of this attack. The findings were as follows: Patient was almost hysterical with pain, crying aloud at intervals. She vomited repeatedly during the examination. Her general condition was good. Pulse 80, temperature 98.4, respiration 20. In spite of the severe symptoms and pain, she did not appear to be seriously ill. The abdomen was not distended, but very tender in right half from the costal border to the pelvic brim. No mass was palpable. There was considerable tenderness over the right kidney region. Murphy kidney test was three-plus.

Vaginal examination showed a moderate amount of menstrual flow. The cervix was small and hard. The uterus was anteflexed, small, apparently fixed and drawn

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\*Surgery, Gynecology and Obstetrics, August, 1927.

over to the right adnexa. In this region and in Douglas culdesac an indistinct, extremely tender resistance was felt. The left adnexa was not palpable or tender. A rectal examination gave no additional information.

She was immediately taken to the hospital where a blood examination showed, red cells 3,310,000, hemoglobin 70, leucocytes 9,100, lymphocytes 24, polymorphonuclear cells 76. Under expectant treatment, the patient's condition gradually improved during the following days. Vomiting and pain subsided. The third day there was a distinct, palpable mass, apparently originating from the right adnexa.

A diagnosis of acute pelvic inflammation was made, probably an ovarian cyst with a twisted pedicle, and operation decided upon.

On opening the abdomen, a small amount of free blood escaped. The right tube was found greatly enlarged. It was entirely black and twisted clockwise one full turn about four centimeters from the cornu. There were a few adhesions surrounding the tubal mass, all of them recent. Findings otherwise were normal.

The pathologic examination was done by Dr. D. H. Nickson, Pathologist to the Swedish Hospital. He reports the following: The total length of the tube was eleven centimeters. The proximal six centimeters had a diameter of two centimeters. At this point the tube turned clockwise one full revolution. Beyond the point of torsion the tube measured five centimeters in length and four centimeters in diameter. The surface of the tube was dark red and was mottled with black areas. On opening the tube, the wall was thickened, the lumen filled with forty-three cubic centimeters of a rather thin bloody fluid. The fimbriated end was closed, presenting a smooth contour. The attachment of the broad ligament did not extend beyond the point of torsion. Proximal to that point it became a thickened, edematous hemorrhagic mass.

The diagnosis was torsion of a hydrosalpinx with early necrosis.

The patient made a good postoperative recovery.

#### SUMMARY

It is certain that we here had to deal with an old salpingitis, which suddenly became strangulated by torsion of the pedicle. The tube was club shaped and the fimbriated end was closed by dense, old organized adhesions which completely obliterated the fimbriae. This pathologic condition could not have occurred in the three days elapsing between the attack and the operation. In a number of the previously reported cases the tube was normal before the torsion.

The differential diagnosis of this case is rather interesting. An acute appendiceal inflammation could be eliminated at once, due principally to the lack of temperature, normal leucocyte count and the general good, nonseptic, condition of the patient. This excellent general condition has been emphasized strongly as constant in many of the cases reported, in spite of severe local symptoms and terrible pain. The main difficulty in this case was the elimination of an acute kidney condition, particularly obstructing renal calculus. The onset of the symptoms was so suggestive of renal colic that ureteral catheterization was contemplated. The absence of pus in the catheterized urine, the development of a palpable mass and the localization of symptoms clarified the diagnosis, and made a pelvic operative condition certain.



The findings at the operation show how necessary it is in this condition to arrive at a correct diagnosis at the earliest possible moment. The bluish, discolored, strangulated salpinx, distended with blood almost to bursting, the walls showing early gangrenous areas, leaves no doubt as to what would have happened if this condition had been unrecognized for any considerable time.

MEDICAL AND DENTAL BUILDING.

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## HERNIA OF THE UTERUS AND TUBES THROUGH THE INGUINAL CANAL (SALPINGOHYSTEROCELE), WITH CASE REPORT

BY JACOB SARNOFF, M.D., BROOKLYN, N. Y.

(Attending Surgeon, Harbor Hospital, Associate Surgeon, United Israel Zion Hospital)

I DESIRE to place on record a case of a right inguinal hernia containing the tubes and uterus. It may not be amiss at the outset to present for discussion some of the interesting facts pertaining to this subject.

It has been asserted that every organ within the abdomen, with the exception of the liver and pancreas, has at one time or another been found in the sac of an inguinal hernia. Hernia of the female genitalia through the inguinal canal, is a relatively rare occurrence. Watson states in his textbook on hernias that, up to 1923, he collected from literature 52 cases of inguinal hernia of the nongravid uterus and 14 cases of the gravid uterus, in all 66 inguinal hernias of the uterus.

B. H., twenty-two years of age, was admitted to Harbor Hospital on February 23, 1927, with the following history:

Shortly after birth, a swelling was noticed in the right inguinal region. This was diagnosed as a hernia and was treated by the application of a truss for about six months during the first year. She also had club feet for which she was operated upon during childhood, with good results. She has never menstruated nor had any of the accompanying menstrual molimina; otherwise she appeared to be normal. She was told that she required some injections which might possibly bring on her menstruation.

For the past five years, the patient has complained of attacks of pain which were located in the right inguinal region. The pain would last from a few hours up to a few days. The attacks varied in frequency, occurring every two to eight weeks. During these attacks the mass in the right side, which was about the size of a pigeon's egg, became more tender and painful. The condition was diagnosed by the family physician as a right inguinal hernia possibly containing some omentum or intestines.

On February 23rd, the writer was asked to operate for the above condition. With the history of amenorrhea, he was prompted to make a careful vaginal and rectal examination in order to ascertain the cause of the amenorrhea.

*Physical Examination.*—A girl, five feet, four inches, weighing about one hundred and twenty pounds, well developed, feminine type, good appearance and color, mammary glands well developed, axillary and pubic hair normal. Has a slight drooping of left upper eyelid. Labia majora and mons veneris somewhat small. Labia minora absent. Extending from either labia at the site of the vaginal opening is a mucous membrane of normal color, with no evidence of hymen or vaginal canal. Urethra and clitoris normal. Anal canal and rectum normal. The internal genitalia could not be felt in the pelvis on bimanual rectal examination. I then concluded that he was dealing with a case where there was an absence of vagina, with the possibility of the uterus and adnexa being present in the hernial sac. With the patient in the erect position, there was an impulse on coughing and a mass about the size of a pigeon's egg could be felt in the right labioinguinal region.

Under general anesthesia, an incision about three inches long was made, one-half inch above and parallel to Poupart's ligament, down to the aponeurosis of the external oblique. The external abdominal ring was readily brought into view. It was about the size of a quarter. The aponeurosis of the external oblique was incised, extending from the external abdominal ring upwards and outwards. The hernial sac was about four inches long. On lifting it upwards away from the abdominal ring and passing the finger underneath, the distal portion of the sac was pulled upon, bringing into view a structure which from its location and relation to the sac simulated the spermatic cord and testis.

As previously stated, the history and physical examination suggested to me the possibility of finding some of the internal genitalia in that sac. The sac was opened about one-half inch away from the external abdominal ring for a distance of about one and a half inches. To his surprise he found that the contents of the sac consisted of the uterus, and right and left tubes. The pedicle to which the uterus was attached was about three inches long and about the thickness of a finger. It apparently consisted of the broad ligaments together with portions of the vaginal walls. The uterus was of normal shape and consistency but the size of a small olive. The fallopian tube, extending from the right cornu of the uterus, was of normal size and consistency though it felt somewhat thickened possibly due to some edema as a result of its disturbed circulation. From the left cornu extended a tube of similar structure. The uterus with the adnexa including their attachments, formed the anterior part of the hernial sac and might thus be called a sliding or Richter's hernia. Part of the bladder could be seen anterior to the uterus and its pedicle. The right ovary was observed extending from the posterior portion of the apparent right broad ligament. The ovary was of normal size and consistency and was about twice the size of the rudimentary uterus. These findings readily explained the amenorrhea as well as the absence of menstrual molimina. It also accounted for the presence of the right inguinal hernia (which was congenital) with the occasional attacks of pain probably the result of partial twisting or strangulation of the uterus and adnexa.

The question of the proper operative procedure was then considered. I decided to remove this rudimentary herniated uterus including the right and part of the left tube, replacing the right ovary, which appeared to be normal, into the peritoneal cavity. A rudimentary uterus of such small size, attached by such an elongated pedicle as the result of malposition and stretching of the broad ligaments and vaginal wall, could serve no useful purpose in being replaced into the peritoneal cavity, and might be subjected to torsion, strangulation, etc. The location and size of the abdominal incision did not permit any further detailed view or study of the relation of these organs to the pelvic floor, bladder, rectum, etc.

The hernial sac was dissected high up towards the internal abdominal ring. That portion which covered the posterior wall of the uterus and its pedicle, thus

forming the anterior part of the sac, was dissected upwards, first incising the peritoneum on the posterior surface of the uterus. The uterus, right and part of the left tube were then removed in the following manner: Two clamps were placed, one to either side of the uterus. The right clamp included the stretched right mesosalpinx to just below the level of the cervix. The left clamp included part of the left tube and its mesosalpinx down to just below the level of the cervix to meet the clamp on the opposite side. The writer did not observe the left ovary and could not say with certainty whether it was there or not. After having removed the uterus, the right tube and part of the left, the cut surface did not show any evidence of a patent vaginal canal. The raw surface was sutured with continuous chromic gut No. 1. The hernial sac was then ligated high up, removed and its stump transfixed under the conjoined tendon. The hernia was then repaired as a typical Bassini except that there was no cord or round ligament to deal with. The conjoined tendon was sutured to the shelf of Poupart's ligament with four interrupted No. 2 chromic sutures. The aponeurosis of the external oblique was sutured with continuous chromic suture. The skin and fascia were closed with interrupted figure-of-eight silk worm sutures. The skin was sutured with continuous silk.

The operation lasted twenty-five minutes, patient in good condition. Sutures were removed on the eighth day. The wound healed by primary union. Temperature was normal throughout the entire stay at the hospital except the day following the operation when it rose to one hundred. Patient was discharged from the hospital twelve days after the operation, feeling perfectly well. The parents were informed as to the operative findings and procedure but the patient is as yet unaware of the above findings.

This condition of prolapse of the uterus through the right inguinal hernia is termed right inguinal hysterocoele. Together with the prolapse of the tubes it might be termed right inguinal salpingohysterocoele, a condition which is indeed very rare and interesting.

The case presents a number of interesting problems: First, as to the etiology of such a condition from an embryologic standpoint; second, the anatomic relations leading up to the development of this prolapse of the uterus and tubes through the right inguinal hernia; third, the physiologic phenomena, so far as the patient is concerned, with regards to her general development, maturity, sex instinct, matrimony, and the probability of a plastic procedure with the ultimate formation of a vaginal canal.

#### SUMMARY

1. Hernias of the uterus in the inguinal canal are generally congenital. The history of this case shows that the hernia was noticed shortly after birth.
2. The uterus in these congenital hernias is generally rudimentary.
3. Accompanying such hernias are other malformations and displacements such as imperforate vagina, etc. This patient had a rudimentary uterus, imperforate vagina, club feet and drooping of left upper eyelid (lagophthalmos).
4. The importance of vaginal and rectal examinations to determine

the presence of the internal genitalia in the pelvis which otherwise might be suspected to be found in the hernial sac.

5. The advisability of hernial repair in the female at an early date to avoid the possibility of prolapse of the genitalia which may lead to atrophy of such organs with its unpleasant results.

A point of particular interest in this case is the fact that despite these malformations, the patient is otherwise fully developed; quite popular and contemplates matrimony. The parents, having been informed of the true state of affairs, are urging the plastic procedure which they were told is possible, in order to make matrimony feasible.

I hope to present at a future date further details of the case, especially with regard to a contemplated plastic Baldwin operation for the construction of a vaginal canal, should such a procedure be deemed advisable.

#### REFERENCES

(1) *Roufart*: Ann. B. L. Soc. Belge de Chir., 1900, viii, p. 228. (2) *Diderick*: Ann. B. L. Soc. Belge de Chir., 1900, viii, p. 239.

1406 ALBEMARLE ROAD.

## A NEW SELF-RETAINING INSTRUMENT FOR THE RUBIN PATENCY TEST AND IODIZED OIL INSTILLATION

BY IRVING F. STEIN, M.D., AND ROBERT A. ARENS, M.D., CHICAGO, ILL.

WE HAVE devised an instrument which may be used with gas or iodized oil, or with any other liquid for testing tubal patency. The difficulties we experienced with the simple cannulas used heretofore were: first, interpretation of the results of the Rubin test; second, difficulty in overcoming leakage at the cervix; third, the awkwardness of holding several instruments in place during the test; fourth, making simultaneous traction on the cervix and pressure against the external os; fifth, maintaining a constant pressure at the cervix after iodized oil instillation long enough to obtain satisfactory roentgenograms. These several difficulties have been obviated by the instrument which we have developed (Fig. 1).

It has been our routine in suitable sterility patients to perform the patency test under manometric control, and when the tubes have been found patent, to introduce one litre of carbon dioxide gas into the peritoneal cavity by the transuterine route. When obstruction is met, transabdominal inflation is done. The patient is then arranged in the Peterson (partial knee-chest) posture on our especially constructed table, and 5 to 7 c.c. of lipiodol is instilled into the uterus, the instrument, meanwhile, remaining in situ. Films are taken, after which the instrument is removed. The patient is kept in dorsal decubitus in bed for several hours until the gas is absorbed and she thereby suffers no discomfort.

The instrument consists of the following: a medium-sized Graves' speculum into which a small spring clip is attached to the lower blade. A short single tenaculum forceps with an aperture anterior to the lock. A modified Keyes-Ultzman cannula with a metal collar fastened about two inches from its tip to prevent back-slide of the rubber olive and to obviate the necessity of making pressure upon

the olive with an additional instrument. The vertical notched spring rides upon a small metal jacket which moves forward or backward upon the cannula and may be fixed at any point by setscrew. The spring is prevented from rotating about the cannula by a small track. Distal to the spring is a stopcock, and at the end, a Luer tip. By keeping a Luer adapter on the rubber tubing leading from the CO<sub>2</sub> supply, and using a Luer syringe for the iodized oil a snug connection is established when using either apparatus in series with the cannula.

The speculum is first inserted into the vagina with the patient in lithotomy position. The cervix and vagina are swabbed with 2 per cent mercurochrome solution and the same is applied to the cervical canal with an applicator. The anterior lip of the cervix is then grasped with the tenaculum and the cannula

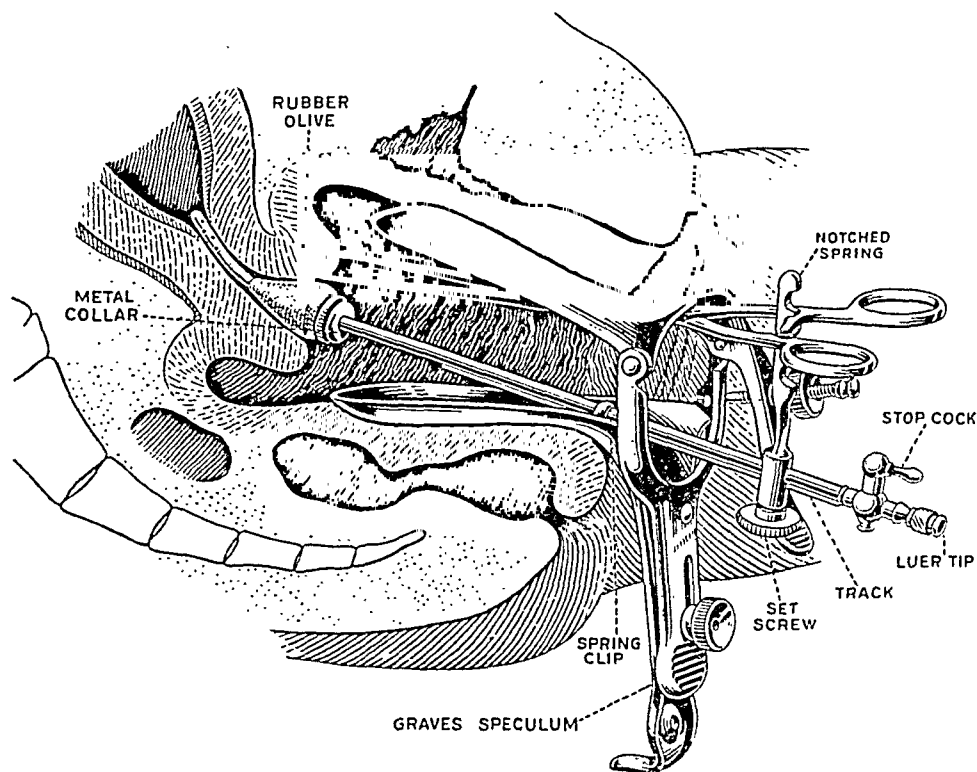


Fig. 1.—The Authors' self-retaining instrument for the performance of the Rubin test and instillation of iodized oil.

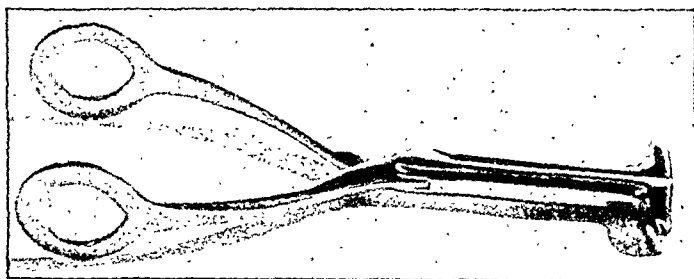
inserted into the cervix. Counter traction and pressure are maintained by the spring. The cannula is then slipped into the spring clip and the apparatus is fixed and self-retaining. We have used this instrument in a large series of cases for the performance of the patency test combined with iodized oil instillation with most satisfactory results. It may be well to have two cannulas on hand on the second of which the metal collar is set about one quarter of an inch farther back than on the one already described. This is only to be used in cases of elongated cervix in which the internal os may be out of reach of the usual cannula. Either cannula may be used in retroversion and retroflexion by removing the jacket with the spring and reversing it. This is possible by unscrewing the stopcock. It is only necessary that the cannula project just within the internal os. Damage may occur from using too long a cannula which may be pressed too firmly against the endometrium and might possibly even penetrate the uterine wall.

## CEPHALIC ROTATING FORCEPS

BY MYER N. MOSS, M.D., ST. PAUL, MINN.

THE instrument illustrated here consists of two separate blades, each having a handle with an outward hook at the end to permit a firm grasp for rotating purposes. The blades terminate in a fenestrated circular ring and the handles are hollowed out, making the instrument a trifle over half the length and weight of the regular obstetric forceps. The construction, however, is of sufficient strength to maintain any force necessary in rotating the presenting part. The cephalic curve, which fits to the sides of the head is narrowest at the handles and widest at the rings. Unlike the obstetric forceps, there is no pelvic curve, so that either blade may be inserted first and on either side of the pelvis and the instrument rotated in any direction without danger of injuring adjacent tissues.

As its name implies, the forceps is devised to act purely as a rotator, so that any attempt at traction will immediately cause the blades to slip off. The instrument should prove of particular value in posterior positions or in transverse arrest of the head and may be used either as a first step for bringing the head into a more



favorable diameter for application of the regular traction forceps, or kept in place until nature's own powers have forced the head to a point where spontaneous delivery is apparent.

When the rotator is to be used as a preliminary step in forceps delivery, the conditions should be the same as those for any forceps operation. When, however, only rotation is desired and the mother, herself, is expected to expel the baby, the dilatation may be somewhat less and the membranes do not necessarily have to be ruptured.

Since it is of prime importance that the exact position of the presenting part be known, the rotator is to be used only by those skilled in the application of the regular obstetric forceps. Under strictest asepsis, with constant lysol or green soap irrigation, the entire hand grasps the head and each blade is inserted between the palm of the hand and parietal side of the head. The blades are gently locked, the hand is removed and rotation made by slowly turning the handles. When the head is brought into the desired position, with the blades in place the mother may now be permitted to continue her pains and bearing down efforts until the rotator stays in position without further assistance, or the obstetric forceps may now be applied to complete the delivery.

302 LOWRY BUILDING.

# A SELF-RETAINING LATERAL VAGINAL SPECULUM FOR CERVICAL WORK

BY WALTER E. LEVY, M.D., NEW ORLEANS, LA.

A GOOD exposure of the cervix is absolutely necessary for cervical amputation, cauterization of the cervix, trachelorrhaphy and the packing of the cervix post-partal.

Various specula are available and some may even resemble the instrument which I herewith submit; but the adaption of the lateral blades, I believe, is original, and it overcomes many of the objections to the other types.

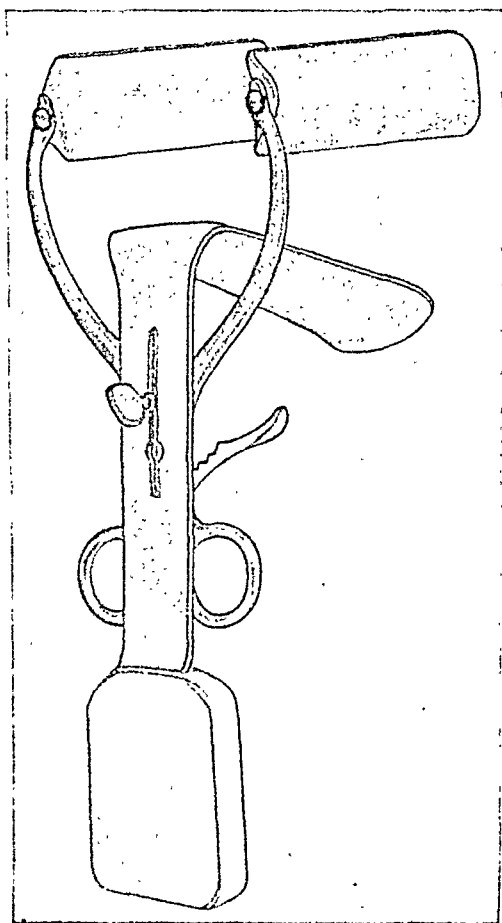


Fig. 1.

The instrument as seen in the illustration is in two parts,—the one with the two lateral blades, and the other a simple weighted speculum. The lateral blades are on swivels, so as to better fit the lateral vaginal walls. Furthermore, at the end of each blade there is a lip which tends to prevent slipping. The length of each lateral blade is 3.25 inches, and the width is 1.25 inches. The blade of the weighted part of the speculum is 3.50 inches in length and the weight is 3 pounds.

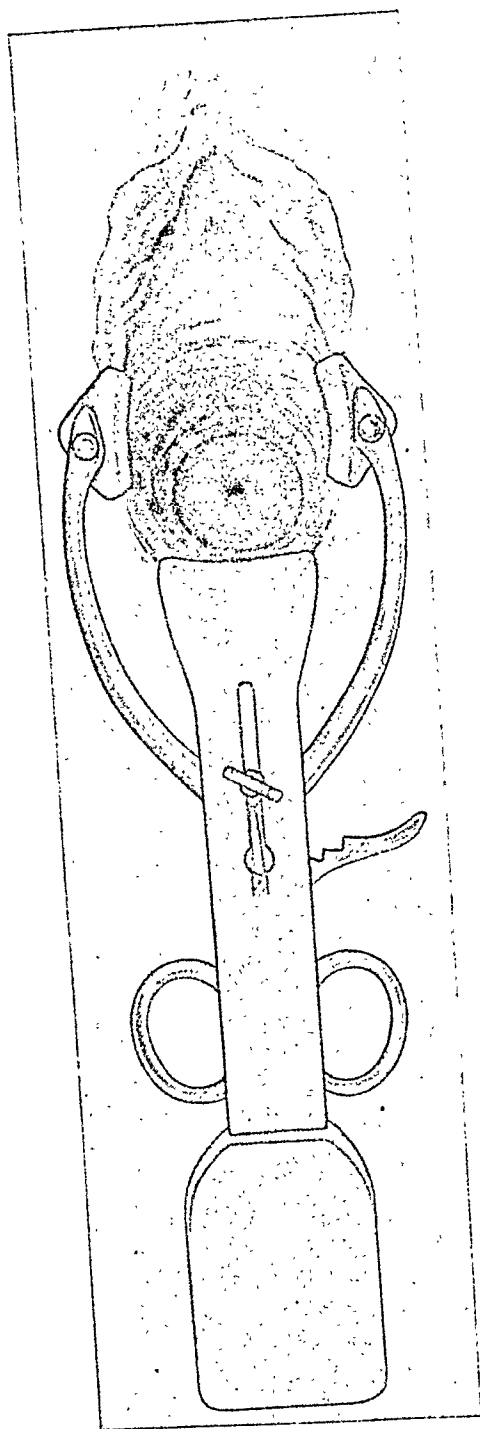


Fig. 2.

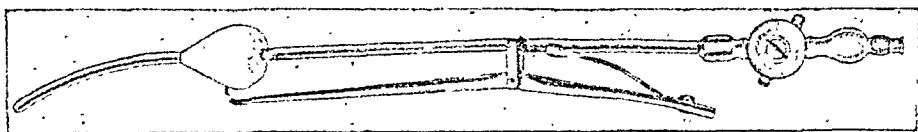


## A NEW UTERINE CANNULA

By WALTER E. LEVY, M.D., NEW ORLEANS, LA.

THE use of lipiodol for intrauterine and tubal radiography is an accepted diagnostic method. I present herewith a selfretaining uterine cannula for this type of work. The entire length of the cannula is seven and one-half inches. From the tip of the cannula to the petcock, however, is six inches.

The two original features are the spring-tenaculum and the adaption of a petcock which fits a Luer syringe.



The tenaculum can be moved up and down the cannula so as to always be able to rest upon the rubber tip which fits into the cervix. Furthermore, the tenaculum can be moved around so as to grasp the anterior cervical lip, even when the curve of the cannula is pointed posteriorly in a retroflexed uterus.

The use of the petcock is merely to close off the cannula and to prevent the lipiodol from escaping when the syringe is removed.

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## AN IMPROVED SHORT OBSTETRIC FORCEPS

By D. A. CALHOUN, M.D., TROY, NEW YORK

THE short obstetric forcep seems to have become more of a curiosity than an instrument of real value and an asset to the obstetric armamentarium. In general, the use of the short forcep in obstetrics is neglected. Practitioners use the cumbersome long forceps for all deliveries whether high, medium, or low operations, and totally ignore the more convenient short instrument, much less difficult of manipulation in low obstetric operations. To be sure, the long instrument is indicated where the head is above the outlet, but it is too large and cumbersome of manipulation for the delivery of a head at, or below the ischial tuberosities. The forceps, easy of introduction, application, and removal to assist a delayed head, whatever its cause, without changing the posture of the patient, is indeed the ideal situation both from the standpoint of the patient and the obstetrician.

Very often, the head remains stationary on the perineum without satisfactory advancement in spite of good pains and the best endeavors of the patient, the delay being due to a relative disproportion between the head and anterior, or posterior plane of the outlet, more particularly the latter. The transverse diameter of the outlet being relatively small, the advancing forehead is forced against the coccyx over which the patient is unable to advance it and labor becomes arrested. The prolonged compression in this situation invites various injuries to the head and brain as well as asphyxia more or less profound, depending on the length of time and the amount of compression.

It is easy to apply the proper type of forceps to such a head without changing the posture of the patient and thus to supplement the forces of labor. Some difficulty is generally encountered when applying the fenestrated blades in this low type of operation. More difficult is the removal when after traction the blades are more or less imbedded into the flesh of the baby's head, not to mention the possibility of an ear being within the fenestration and subject to injury and even severance during the removal. The head can be made to advance with the instrument shown



Fig. 1.

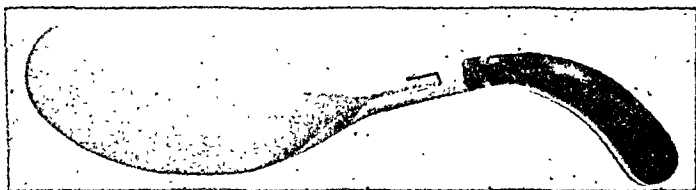


Fig. 2.

until the forehead is accessible, after which the removal of the blades, due to their smooth solid surfaces can be quickly and easily accomplished, the delivery of the head completed slowly and at the pleasure of the operator.

The short forceps herewith presented is ideal for low applications. In order to obtain the desired cephalic application it is desirable to have a blade which can be introduced easily and slip around the circumference of the pelvis.

The forceps illustrated was designed by the author to avoid the objectionable features of the usual types of short forceps.

108 SECOND STREET.

# Society Transactions

## THE NEW YORK OBSTETRICAL SOCIETY

MEETING OF OCTOBER 11, 1927

THE PRESIDENT, DR. WILLIAM P. HEALY, IN THE CHAIR

DR. ELIOT BISHOP reported a case of **True Ovarian Pregnancy**.

This case is reported because, in the first place, the specimen is so complete and obvious in the gross, and in the second place, because we stumbled upon it through an error in diagnosis, and in the third place, through a too quick diagnosis of tissue in situ we were nearly led into a complete extirpation of the pelvic organs.

The patient, at the time of operation in March, 1927, was thirty years old. Dr. Bishop had delivered her twice, the last time in December, 1925. Her previous pelvic history has some points of interest. She became pregnant in October, 1921. In March, 1922, the abdomen was opened for fibromyoma, complicating the pregnancy, but the operator decided to leave it undisturbed. She was not happy over the occurrence, and her family physician referred her to Dr. Bishop on July 31, 1922. Examination then showed a mass 7 x 5 cm. on the *left* cornua of a uterus which extended 34 cm. above the symphysis. He delivered her five days later,—the character of the labor being of no import. Her discharge examination about seven weeks later showed no mass on the fundus and it was presumed that the fibromyoma had involuted with the uterus to an impalpable nodule. Her second labor was uneventful. At the discharge examination three months later—March, 1926, on a fundus of good size and position, at the *right* cornua, a fibromyoma, 3 x 2 cm. was present. Her period two weeks before, had lasted seven days and was profuse and slightly clotted.

Nearly a year later she came in because she had been flowing during all the time since the onset of her last period—February 7th. The flow was not heavy; she had some lassitude and also right iliac pain. Abdominal examination at the time showed an ill-defined mass in the right iliac fossa; vaginal examination showed a large anteverted fundus with a mass separate from it about 8 x 5 cm. in the right fornix and a diagnosis of probable fibromyoma on a pedicle or possibly an adnexal mass was made. She entered the Brooklyn Hospital and was operated upon March 9, 1927. The abdomen was opened through the old scar. The left adnexa were normal; there were two fibromyomata below the left cornua of the uterus. The right adnexa formed a mass that the pathologist inspected in situ and said "malignancy." Of course, complete extirpation was planned. However, to be more certain, the right adnexa were removed for section, the cautery knife being employed, and on cross-section the pregnancy was easily demonstrable. Because of the fibromyoma, the cervical hysterectomy followed, the left adnexa being left because of the patient's age. Her convalescence was excellent and she was seen again in May, with no complaints and no demonstrable pathology in the pelvis.

The pathologic report is as follows: Specimen consists of uterus, one tube and an ovarian mass. The uterus measures 9 x 6 x 6 cm. From the serous surface of the uterus, irregular nodules are projecting—the largest measures 2 cm. in diameter. On cross-section these seem to be calcified completely. Endometrium is swollen and hemorrhagic. Uterine wall averages 2½ cm. in thickness. Cervix narrow and shows nothing unusual. The tube and ovarian mass is separated from the uterus. The tube is 9 cm. in length altogether; has free fimbriated end. At

the isthmus it measures 4 mm. in thickness. Ampulla measures 6 mm., has smooth surface and is pale in color. It is uniformly narrow.

Cross-section shows narrow lumen. The mesosalpinx is about 2.5 cm. in width. It separates the tube from the ovarian mass. Ovarian mass measures about 6.5 cm. in diameter. It seems to be well encapsulated, has black appearance. Part of this, however, shows white substance of the ovary. On cross-section, this mass shows a round cavity about 2.5 cm. in diameter, in which a fetus is lying attached to the wall by the cord. The fetus measures 8 mm. in length. The lining of the cyst is smooth. The wall of the cyst consists of layers of old blood clot. The blood clot is confluent with the hemorrhagic substance of the ovary.

*Microscopical Section:* The ovarian mass shows partly organized blood clot with a surface which contains chorionic villi. Section of the isthmic end of the tube shows narrow lumen, cylindrical lining; no changes in structure are noted.

*Diagnosis:* 1. Ovarian pregnancy; 2. normal tube; 3. multiple myomata of uterus with calcification, and 4. chronic endometritis.

DR. HAROLD BAILEY presented **A Review of the Work of the Second Obstetrical Division of Bellevue Hospital.** (For original article see page 462, April issue.)

#### DISCUSSION

DR. B. P. WATSON was interested to hear Dr. Bailey place such reliance on antistreptococcus serum in septic cases. His own experience of late has not quite borne that out, especially where there was definite blood infection. The number of cases of accidental hemorrhage and premature separation of the placenta, was also rather striking. He did not know whether the doctor included cases that had lost less than 1,000 c.c. blood because in a great number of cases where there is a very slight blood loss before delivery and where there must have been some slight separation of the placenta, this is of no moment either from the point of view of the mother or the child.

DR. J. O. POLAK was impressed by the difference in the results following the conservative method of treatment of eclampsia versus the more radical interference.

The other point of interest was the relatively large incidence of postpartum hemorrhage. Dr. Bailey has answered the matter by his own criticism. Evidently the intern resident staff in his hospital was not taught the physiology of the placental stage as it should be taught. Dr. Polak found that since leaving hands off the patients, that there was a marked diminution of postpartum hemorrhage.

DR. A. B. DAVIS did not agree with those who advocate rectal examination as being better and safer than vaginal examination in obstetrics. Rectal examinations do not provide the information sought. By lifting forward the rectovaginal septum and the posterior vaginal vault, often with a pool of accumulated secretion, there is greater danger of injury and infection than by vaginal examinations. In the out-patient department of the Lying-In Hospital, a vaginal examination of cases in labor is required every two hours until delivery. More often than not, these examinations are made by pupils or doctors possessed of very little obstetric training. This plan has been followed for more than thirty-seven years, in something over eighty-eight thousand cases, and they had yet to see bad results from this procedure. The development of sepsis and morbidity is quite as low as in the in-door department. It is fair to state that in some one hundred and twenty-five postpartum cases there is an average, through the year, of not above ten cases a day, showing an 8 A.M. temperature above 99° F. This includes operative and complicated cases. In this service a few cases of septic infection develop. The majority of such cases are brought in as emergencies already infected. In their

treatment Dr. Davis and his staff had used various serums and methods proposed to combat puerperal sepsis. Thus far, they have been unable to report any results of value from their employment. "So long as we continue to have emergency cases which have, in many instances, been previously mismanaged by incompetent doctors or midwives, we are bound to meet with puerperal sepsis, especially in the city hospitals. This state of affairs will exist until the rank and file of the profession who practice obstetrics, and the lay public, become so educated that they will not tolerate the occurrence of such cases in anything like the number met with at the present time."

DR. W. S. SMITH said that Dr. Bailey seemed to use high forceps a good deal more often than at the Brooklyn Hospital.

DR. BAILEY (closing), in reply to Dr. Watson's remarks said, that the serum is useful when the streptococcus is in the blood, but in none of his cases, even in those that died, did they find this organism in the blood, although the infection was apparently streptococcic, as positive cultures came from the body of the uterus. He believed the early use of polyvalent antistreptococcic serum to be of great aid. It is not of much value late in the disease because the bacteria are then located in too many places. He found that after the administration of the serum there was a tendency to the production of abscesses in the parametrium. There seemed to be a localization of the organism about the uterus.

Dr. Bailey believed that the uterus should be left alone and not handled, to avoid hemorrhage. Attempts to shorten the actual labor by squeezing out the placenta are bad.

In this service ether is used, chloroform being employed for ordinary delivery over the perineum but in operative work ether is given unless the patient is in shock, and then gas-oxygen in the proportion of 3 to 1.

In reply to Dr. Ryder's question about pituitrin, Dr. Bailey said they did not give it unless forced to do so; in other words unless the uterus is empty. In all bleeding cases, however, they give 1 c.c. of pituitrin immediately and, if the placenta is still retained, compress the uterus as much as possible in an attempt to express it with the first contraction after the administration of the pituitrin. They have not given pituitrin, routinely, before the delivery of the placenta.

In reference to Dr. Davis' remarks about vaginal examination: there is certainly a difference between the indoor and outdoor cases. The outdoor women have been through many labors. Bellevue conducts an outdoor student service where the students make a limited number of vaginal examinations. However, they were literally forced to adopt the method of no vaginal or rectal examinations because of the amount of sepsis that preceded the year 1922.

In the conduct of the service, they have to free themselves of responsibility for infections. Many of the women have had no prenatal care or advice and come in for labor with a history of intercourse on the day or the day before the pains start. When Dr. Bailey joined the Bellevue service in 1909 every woman admitted was given a vaginal douche. Although not done now, the question arises as to whether they shall not be obliged to return to some form of antiseptic care.

PROF. E. ESSEN-MÖLLER presented a paper by invitation, entitled **Is the Vaginal Cesarean Section Justified in Placenta Previa?** (For original article see page 612.)

#### DISCUSSION

DR. G. H. RYDER said that, in discussing this question, it is well, in the first place, to remember that vaginal cesarean section can be safely done only by the most skillful operators. It cannot be done safely by others. In the

second place it is well to consider that the term placenta previa is used to describe widely differing conditions. High lateral placenta previa is often such a comparatively harmless condition, that it needs little if any treatment, while the complete or central placenta previa is one of the most terrifying and fatal conditions known to obstetric practice. Between these two extremes, placenta previa is slightly or greatly dangerous as it approaches more closely one or the other extreme. Vaginal cesarean section performed by a skillful operator in the milder forms of placenta previa, might easily yield safe results. So would many other simpler procedures. In the severer forms of placenta previa, vaginal cesarean section, in his opinion, could end only in disaster. High abdominal cesarean section, on the other hand, in these severer forms of placenta previa, appears to be the safest procedure (where the patient is seen early before there is much dilatation). The mother can usually be saved if there has not previously been too much bleeding, and the fetus has the best possible chance. In case of suspected infection, the cesarean section may be followed by hysterectomy, thus preventing spread of the infection.

Prof. Essen-Möller has been very fair in summing up the pros and cons of this question. Dr. Ryder believed that this series of nineteen cases was composed chiefly of the milder types of previa. Otherwise the mortality would have been higher. In the severer forms of placenta previa, vaginal cesarean section is a very dangerous operation and distinctly contraindicated.

DR. A. C. BECK said he had never done vaginal cesarean section for placenta previa, but had three cases in which the placenta was in the lower uterine segment and he had done a low flap cesarean section. In none of those instances was it known at the time of the operation, and not until the uterus was opened from above. In one of the cases there was very considerable hemorrhage, but the uterus was closed and the patient ultimately recovered.

In the Long Island Hospital clinic, if the previa case is to be delivered by section, they usually elect the high cesarean section rather than the low.

DR. B. P. WATSON considered that one of the very important points Prof. Essen-Möller brought out, was that there is no more friability, or liability to tear, in the cervix of a placenta previa than in the ordinary case. It has always been taught hitherto in our textbooks that the great danger in placenta previa was the excessive softening and friability of the cervix, and it leads one to ask whether there would not be just as much tearing of the cervix in a case which was not a placenta previa if delivered by forcible extraction of the child.

DR. HAROLD BAILEY wanted to ask whether it was necessary to do a craniotomy in extracting the heads of any of the babies that were stillborn? His experience with the vaginal section for placenta previa was limited to two cases early in pregnancy, and he had but slight experience with the vaginal section for eclampsia, but was convinced that it is a difficult matter to drag a full-term head through with an anterior section.

DR. G. L. MOENCH said that from his own observations he could verify what Professor Essen-Möller had brought out, that the cervix is not especially friable in these women, and that cesarean section in the lower uterine segment in cases of placenta previa, not only does not increase the mortality but actually decreases it. He did not see, therefore, why there should be any difference or at least very much difference, aside from technical difficulties, whether one goes in from below or from above. The same area is involved in each instance and the bleeding is easily controlled. Personally he had never had any special trouble in suturing the cervix even in those cases where the incision was very low. In one case the incision was so low that the upper part of the vagina was opened but no technical difficulties were encountered and bleeding easily controlled.

A point not brought out sufficiently in the literature, is the fact that spontaneous deliveries, where no examination or other manipulations have been carried out and which despite this have postpartum infections, are not infrequently cases which have had slight bleeding for some time before labor. Such bleeding diminishes the normal vaginal acidity, which is especially high in the pregnant woman, and thus breaks down the natural protective forces found there. Of course where intercourse has taken place the day before labor, or manipulations have been resorted to, it is often impossible to avoid infection.

PROF. ESSEN-MÖLLER in closing, spoke as follows: "In response to the question as to whether I have done the posterior incision or only an anterior one, I would say that in all my cases I have used the anterior incision only, and I am of the impression that the anterior incision is quite sufficient to extract a child at term. In that connection I can answer the question asked by Dr. Bailey, by stating that I have not found it necessary to resort to craniotomy. The two deaths that I remember were not due to the fact that I could not extract the head through the incision, but because I had not made the incision large enough in the beginning, and then rupture occurred.

"I should like again to lay stress upon the pliability of the cervix. It is remarkable in doing vaginal cesarean section for placenta previa that there is the same feeling in the cervix as, for instance, in a case of eclampsia. It is not more pliable. At least in my cases there has been no more bleeding from the incision than in ordinary cases. The danger lies in the fact that you do not make the incision sufficiently large in the beginning and it is then that rupture occurs.

"Very few of my cases were in primiparae and I can say without hesitation that I am not so anxious to do a vaginal cesarean section in primiparae.

"I have the impression from this discussion that there is not much inclination to do vaginal cesarean section in this country. I can understand that attitude. I tell you once again I am very uncertain if it is right, but it may perhaps interest you to tell you one thing. In France, where they can really do vaginal cesarean section very neatly, they have not done that operation so far as I can tell. It is only Brindeau, of Paris, who does vaginal cesarean section. Other Frenchmen do not want to do it. Brindeau and his school have begun to do that operation in cases of placenta previa, and in the last edition of Bar and Brindeau's textbook, it interested me to note that he (Brindeau) expressly says that in some cases he is of the opinion that the vaginal cesarean section is the best procedure for special cases."

DR. H. N. VINEBERG asked if the uterus is drawn down after the baby is removed, in order to suture the incision in the anterior portion of the cervix, because while he had not done the vaginal incision through the uterus for placenta previa, he had done it for a great many other conditions, particularly in cases of hydramnios and hydatid mole, and found it is rather difficult to get the upper end of the incision down in a good many of these cases. In some cases operated on in which care was not taken to suture the upper angle of the incision, fistula resulted through the vagina.

PROF. ESSEN-MÖLLER said that he always closed the upper angle. An assistant makes pressure abdominally on the fundus of the uterus and presses it downward. In that way it is easy to get to the upper angle of the incision.

# CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF JUNE 17, 1927

DR. F. LEE STONE (by invitation) read a paper entitled **Lipiodol and Roentgen Ray as a Diagnostic Aid in Gynecology**. (See page 662.)

## DISCUSSION

DR. PAUL FOX believed lipiodol had a definite place in gynecology, particularly in the diagnosis of occlusion of the tubes. The Rubin test will tell, in the majority of cases, whether the tubes are open or closed but one could not tell where the occlusion was unless there was some means of visualizing it. With the aid of the lipiodol one could select the operable and nonoperable cases. Also in differentiating between an intra- and extrauterine mass it is difficult without the x-ray to know whether a certain mass is connected with the uterus or not.

Regarding patency of the tubes he wished to emphasize the necessity of a check-up picture taken several days later as well as at the time of injection. This rules out a possible error in cases where the material escapes from the tube slowly. He reported a case in which air patency test repeated on three different occasions showed that the tubes were closed. X-ray picture after lipiodol injection showed definite closure at the fimbriated end. No check-up picture was taken. The patient was put on conservative treatment and two months later she became pregnant. It is possible that the closure was not absolute. This would have been proven by a check-up picture taken several days later. He has also found that stereoscopic pictures are of value in helping to diagnose the position of the uterus.

DR. N. SPROAT HEANEY did not think it was a method which should be used primarily to ascertain the patency of the tubes because the air pushed through the tubes was much less likely to wash any infective material into the abdominal cavity than was a fluid.

In his opinion, lipiodol should be reserved for locating obstructions when the air shows that the tubes are occluded, but even then the need is limited for experience with the air method teaches much. One can tell fairly well by the amount of air that passes through the uterus whether the obstruction is at the uterine end of the tube or at the fimbriated end. Also the patient has a pain in the sides if the distal end of the tubes are closed, while if the uterine end of the tubes is closed the pain is in the uterus. Because of this he felt that fluid should be used in only a very restricted number of cases. He did not consider it any more infallible than the air method.

Another point is that in all the papers on lipiodol injections a good deal of stress is laid upon the tortuosity of the tubes. This he interpreted as only a sign of overdistension of the tube.

DR. JOSEPH L. BAER said that after Dr. Rubin demonstrated his method of insufflation of the tubes in Chicago in 1920, he took it up in dispensary practice and later in private work and has used it ever since. At first he surrounded himself with every sort of precaution, of course ruling out all pathology in the pelvis. Recently he has been a little less careful in doing the blood work and in making cervical smears. Recently he opened the abdomen in the case of an apparently normal patient, free from rise in temperature, the intention being to do a Gilliam suspension, but he found both tubes filled with free pus dripping from open fimbriae. Among other thoughts he had at the moment, was what might have happened had he attempted a patency test on that particular patient.



DR. STONE (closing) agreed with Dr. Heaney and the others that the possibility of doing some damage must be borne in mind. Most of the cases he had worked on were those of patients who gave a history of sterility and a desire for correction of that condition, or were preoperative. In checking up the films it was always interesting to see the picture that was taken one minute and one three minutes later and noting the change that had taken place. The fimbriae will fill up in one instance and not in another, and in the cases that are clearly obstructed a picture taken several days later will show free lipiodol in the pelvic cavity. In the cases where one tube shows patency and the other obstruction there is a possibility that both tubes are patent with a temporary spasm on one side, because the fluid will naturally pass out where there is the least resistance. He had encountered no untoward symptoms in any of his cases that he was aware of and had been able to check up on ninety-five per cent of them, but the danger of carrying something in must always be kept in mind.

DR. CARL P. BAUER (by invitation) read a paper entitled **A Comparative Study of the Convalescence of One Hundred and Fifty Selected Cases of Vaginal, Supravaginal and Total Abdominal Hysterectomy.** (See page 680 for original article.)

#### DISCUSSION

DR. N. SPROAT HEANEY considered it was very annoying to have a patient after a successful operation for fibroids return complaining of leucorrhea. After a few such cases one is tempted to remove the cervix with the uterus so as to have the patient relieved of all her complaints. At the May, 1926, meeting of the American Gynecological Association, a paper was read on the routine removal of the cervix in all cases of hysterectomy, the reader claiming that he was removing an active disease which might be a forerunner of cancer in many cases. In order to guide his actions Dr. Heaney made a study of his own cases, but when he tried to compare all of the supravaginal cases with the abdominal, he found they represented different types, and to get them on a comparative basis he made certain restrictions solely for the purpose of studying the actual results, making it more an anatomical study than a study of pathology. Considering only cases with hemoglobin above 70 per cent, leaving out all patients with inflammatory tubes, and all the cancer cases, those with elevated blood pressure, with albumin and sugar in the urine, only fifty out of the number of complete abdominal hysterectomies were left. Then he took fifty others running seriatim, supravaginal and complete hysterectomy. There was one death in each series, that was due in the supravaginal operation to a slip in the ligature, and he felt could be attributed to technic rather than to the intricacies of the operation itself. The other case was one of postoperative peritonitis where every operative precaution was used, so he felt that this mortality was inevitable.

Dr. Heaney felt that with skill and attention there was little difference in the long run in the mortality between the supravaginal and the complete abdominal hysterectomy. There was an overwhelming difference in the morbidity. No matter how great the care in removing the uterus and cervix and bringing it out through the abdominal wall, they had stitch abscesses and inflammatory reaction in the abdominal wall. In 150 cases of supravaginal hysterectomy, only three cervixes were subsequently removed because of intractable leucorrhea. None of these was cancerous. Under such circumstances he felt that they were not saving the patient a very great risk from cancer, and that this was not compensated for by the increased morbidity from removal of the cervix routinely. Now he removed the cervix only when it was badly lacerated or infected, providing the anatomic conditions do not

make it a serious operation. Sometimes the cervix is very broad and hard to get at and in such a case it is better perhaps to remove the cervix later from below if necessary rather than to attempt a complete operation under difficulties.

DR. WILLIAM C. DANFORTH assumed from the tone of the paper and from Dr. Heaney's discussion that it should be emphasized that the routine operation should be the supravaginal rather than a total one, and was inclined to agree with this. He thought the mortality in both was two per cent, but it must be remembered that the figures came from a comparatively small number of cases. It must also be remembered that the mortality of the supravaginal cases was due to a technical slip, and one must never forget to consider the place where the operation was done. The mortality in a given operation is quite different in one hospital from that in another, as was definitely disclosed by the late Dr. J. G. Clark, who brought out the fact that the mortality rate in the supravaginal hysterectomy in a good clinic in expert hands ran a trifle over one per cent, while over the country so far as statistics showed it ran about four and one-half or five per cent. The difference in the mortality in the complete operation was probably infinitely greater, and in the country over probably ran somewhere around eight or nine per cent in the hands of the average surgeons. As a routine operation he felt that it was probably much safer to emphasize the supravaginal than the complete procedure. In the hands of Dr. Heaney and those who are doing a great deal of work, the two operations would not have anything like that difference in mortality.

Regarding the risk of cancer in the retained stump, Dr. Danforth believed the risk was overestimated.

DR. BAUER, in closing, said that in this series practically all of the cases were fibroids and the tubes and ovaries were normal. The series did not include any pathology outside of the uterus and so would not apply to pus tubes or anything else. The patients were all in practically the same condition physically, and the pathology present when the uteri were taken out by the abdominal route was too large to permit of them being removed supravaginally.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Collective Review

### A REVIEW OF THE GYNECOLOGIC LITERATURE FOR 1927

By SYDNEY S. SCHOCHET, M.D., F.A.C.S., CHICAGO, ILL.

THE year 1927 marks but little advance and progress in gynecology. While many of the newer theories and newer methods of examination eventually will prove of great advantage, yet suggestions for new modes of treatment in general appear to be based on mere guesswork. Lack of definite information concerning the physiology of menstruation, of cell growth, and ovarian function is responsible for many a ridiculous and confused hypothesis, for reckless enthusiasm as well as ignorant pretension about certain methods of treatment. A great many bogies, which still haunt our specialty, deserve to be shooed forth into the limbo where other similar bugbears now lie forgotten.

Pelvic x-ray photography appears to be the outstanding topic of the gynecologic literature of 1927.

While the recent advances in biochemistry and allied subjects have established numerous facts in the promotion of science, yet there is in the present day undue vaunting of these contributions in the field of gynecology. Too often the gynecologist expects the test tube with the precipitating red blood cells, or x-ray picture of the lumen of the fallopian tube to give the diagnosis or desired clue to the degree of sepsis or the causes of sterility. These new fads and fashions in research,<sup>1</sup> especially in gynecology, are not infrequently permitted to obscure the merits of that which has preceded it. Mendel<sup>2</sup> of Yale University has uttered a frank warning against these dangers in chemistry and physics.

At no time in the past has the specialty of gynecology been more flooded and more threatened with new procedures, new laboratory tests, and new technics of operations as it is today. While we are not blind to the virtues of the new innovations, including pelvic photography and motion pictures of the pelvic organs, yet there appears to be current a great deal of misconception regarding the true pathology of pelvic lesions. But while this is true in many instances, it does not mean that we cannot point to many valuable and epochal contributions in the field of gynecology.

#### GENERAL PROBLEMS

It would seem natural that by now a definite evaluation has been established of the sedimentation test which is very simple and easy to carry out in gynecologic work. Yet there appears to exist a considerable difference of opinion as to its true value. Williams<sup>3</sup> con-

cludes that the study of the leucocytes and temperature curve remains the more stable and reliable index for diagnosis and prognosis. Benischek and Douglas<sup>4</sup> have studied the sedimentation test in 250 consecutive gynecologic cases, and believe that it gives valuable information for establishing a diagnosis and prognosis when considered in relation to the entire clinical picture, but it does not indicate the patient's resistance to infection and is not of demonstrated prognostic value. Black,<sup>5</sup> on the other hand, has utilized this test in 100 cases of a series of 550 pelvic infections, and finds it a very valuable adjunct in determining the proper time for operation, and a good prognostic aid in gynecologic conditions.

Meaker<sup>6</sup> is of the opinion that the study of gynecology can be materially enhanced, if case-teaching exercises were included in the regular, prescribed courses. Bloodgood<sup>7</sup> strongly urges the study of tissues in the operating room for a correct diagnosis and for determining the method of treatment. As Huxley states, "Science is nothing but trained organized common sense." It is evident the more exact methods we employ in teaching the specialty of gynecology the fewer erroneous interpretations and faulty hypotheses we will formulate.

Curtis<sup>8</sup> gives a very clear and concise exposition of the indications for surgical intervention in pelvic lesions of infectious origin. Only mere references can be made to his deductions based on a correlated laboratory and clinical study of pelvic infections pursued continuously for several years. Conservatism, drainage, and the great dangers of introduction of infection from without are the chief points to be observed. These facts are in harmony with modern conceptions of pathology and immunity. Wilkie<sup>9</sup> in a study of acute infections of the lower abdomen warns against the dangers of the present tendency to standardize the treatment of abdominal lesions. Each case must be considered as a problem in itself, to be dealt with under the dictates of sound surgical principles. Maes<sup>10</sup> considers every acute abdominal condition as a potential catastrophe and feels that scientific methods of handling these conditions are yet to be generally applied in view of the still universally high death rate.

Polak and Kirk<sup>11</sup> review the problem of blood transfusion and consider it the most valuable curative and prophylactic measure in our armamentarium. It should be more widely employed to combat morbidity and mortality in gynecologic cases.

It may be said that the claims for protein therapy rest upon empiric rather than scientific grounds. Many views as to its mechanism have been suggested, namely, activation of the blood plasma, stimulation of cells, and increased permeability of the capillaries. If it could be conclusively shown that protein therapy actually stimulates cellular activity (mesenchymal), then it would rationally be the procedure of choice in gynecology. Unfortunately it has somehow become a notion among many gynecologists that a certain amount of protein therapy is necessary to induce the pelvic organs to undergo resolution of inflammatory products. Averett<sup>13</sup> considers protein therapy as a most valuable means to aid the organism in resolution of products of acute and subacute processes.

The report of a new and practical abdominoscope by Sweek<sup>12</sup> is one among some other innovations in diagnosis. There certainly exists a definite tendency to invent new instruments.

## ANESTHETICS

In aged or debilitated patients a general anesthetic is often contra-indicated, either due to lesions in the kidneys, heart, and blood vessels, or to disturbances of a metabolic character. For this group of cases, Murphy<sup>14</sup> suggests spinal anesthesia, as it involves less danger to the patient and is an ideal method. If careful preliminary, pre-operative preparations are made, it offers a rapid, effective method of election, especially in elderly women. McMullen<sup>15</sup> reports a series of 392 spinal anesthetics and concludes that this procedure does not fulfill all of our ideal requirements. It failed to produce anesthesia in 2.5 per cent of the cases, and it is often associated with nausea, vomiting, and at times, alarming vasomotor symptoms with respiratory collapse.

Lundy<sup>16</sup> in an editorial on the present-day requirements in anesthesia maintains that we do not possess an ideal routine anesthetic agent due to the environments and the many diseases complicating modern life of man. Gellhorn<sup>17</sup> believes that local anesthesia fulfills the desideratum in gynecology to a very great extent and is past discussion. Local anesthesia is a forward step in the domain of gynecology and is not due to an impulse for new methods or mere desire for innovations.

Strauss and Rubin<sup>18</sup> report a definite decrease in the coagulation time during and shortly following the administration of ethylene gas. De Takatas<sup>19</sup> gives a very extensive review of splanchnic block and believes that ample clinical evidence in well selected cases, clearly demonstrates its advantages over general anesthesia. Hatcher<sup>20</sup> offers an exhaustive review of rectal administration of ether and oil and concludes that, while this method has certain well-defined advantages, yet the depth of anesthesia is not under such perfect control as with inhalation, and this disadvantage alone is so great that it must often outweigh all the advantages. Lack of perfect control of narcosis sometimes means death to the patient.

## EXTERNAL GENITALIA

Since the publication of Symmers on granuloma inguinale many cases have been reported in the United States. Schochet in 1921 collected 65 cases of granuloma in the States and reported a case originating in Chicago. Norris and Vogt report the cure of granuloma inguinale with radium therapy. This method of treatment is at variance with the results of other workers.

Montgomery and Culver<sup>22</sup> call our attention to the comparative frequency of lichen planus of the semimucous membrane of the pudendal region. This condition is often confused with syphilis of this region.

Gordon<sup>21</sup> reports a case of sarcoma of the vagina. This is a very rare growth of the rectovaginal septum exclusive of sarcoma botryoid. The benign fibromyoma is also only infrequently encountered. Less than 200 cases have been recorded in the literature, as cited by Ingraham.<sup>23</sup>

Complete inversion of the vagina following panhysterectomy or associated with procidentia often tests the skill of the most experienced gynecologist. Not infrequently hernia of the vagina is confused with prolapse. Failure to differentiate between these two con-

ditions accounts for poor operative results. In a hernia of the vagina there exists an extension of the peritoneum between the rectum and vagina which must be obliterated before a cure can be obtained. Miller<sup>24</sup> reports the cure of a case of prolapse of the vagina following panhysterectomy with a modified Rawls or Bissel operation for cystocele. He attaches the upper end of the vagina to the peritoneum and fascia about an inch below the promontory of the sacrum.

It is a well-known fact and the sad experience of many gynecologists, that operations for vesicovaginal fistulas frequently are not successful. This is the true reason for the existing multiplicity of operative procedures. For that group of cases in which the fistula lies in close proximity to the ureters, Hugh Young<sup>25</sup> now suggests that the suture of the fistula be carried out from within the bladder through a suprapubic incision. In the case cited, the patient previously had been subjected to eleven futile operative attempts to close the fistula. Roeder<sup>26</sup> advocates the use of thick vaginal flaps sutured through the suprapubic route, and reports two successful closures.

The formation of an artificial vagina with various technics and modifications have not given the desired results in most cases. The classic Baldwin operation appears to be the one most frequently performed, although the Schubert operation has gained much favor on account of its lower immediate mortality. Schubert<sup>27</sup> reports 20 operations done by himself and reviews 75 additional reported cases with a total mortality of 1.5 per cent, as compared with the 12 to 20 per cent for the Baldwin operation. Judin<sup>28</sup> cites 106 instances of the Baldwin operation with a mortality of 14.1 per cent. Baldwin<sup>29</sup> reports that such statements are at variance with the results of American gynecologists and his own results, showing a mortality of only 5 per cent. Baldwin is of the opinion that the difference in mortality statistics is due to departure from the original technic.

#### UTERUS

There are six well-defined variations in malformations of the uterus in which all anomalies of that organ can be classified; yet we are still in the dark regarding their actual genesis. Double uterus is accepted as due to failure of fusion of the genital ducts, but there is no convincing evidence why the müllerian tissue does not unite in a given case. The more common theories advanced for this condition are: disturbances of the intestinal tract, the rectovesical ligament, and particularly abnormal separation of round ligaments.

Malformations of other parts of the genital tract are usually associated with anomalies of the uterus. Moench<sup>30</sup> reports a uterus duplex bicollis with superfetation. Dannreuther<sup>31</sup> points out that contrary to the legendary textbook teachings, sterility is not commonly associated with malformations of the uterus. This author noted 13 patients with such defects of whom 11 were married; five of them had never been pregnant, but the other six produced 16 children and 11 miscarriages. Levison and Wolfson<sup>32</sup> report a case of uterus didelphys. This is a comparatively rare condition.

Intramural abscess of the uterus is not mentioned in most textbooks of gynecology and obstetrics, but there is no doubt that this condition occurs with much greater frequency than the reported cases in the literature would suggest. Feiner<sup>34</sup> reports in detail the gross findings of this condition with a careful summary of the subject.

Riviere<sup>35</sup> extensively discusses the value of physical therapy for uterine affections. While there is no doubt that there are indications for their use, too much emphasis has been given to their efficiency and importance. The many classifications of the electric currents (of which we possess very little accurate knowledge) and their uses in gynecology should arouse the suspicions of every well-trained gynecologist.

Rosenzweig<sup>37</sup> reports a case of synechtial endometritis with a discussion of its treatment. These cases are often classified as "atypical chorioepithelioma" of Marchand, but Ewing has clearly shown these growths to be nonmalignant.

Bland<sup>38</sup> reports a case of hydatidiform mole which appeared first as a benign growth and later assumed malignant characteristics. He emphasizes the lesson taught in this case and concludes that it is better to resort to radical measures in all suspected chorioepitheliomata rather than to depend upon incomplete explorations.

Graves and Smith<sup>39</sup> record an unusually rare condition, namely, cirroid aneurysm of the uterine artery. The authors believe that only one other similar case has been reported in the literature.

Lecène and d'Allaines<sup>40</sup> describe in detail an operation for the removal of the fundus with conservation of the ovaries and part of the uterus for the purpose of menstruation. Buettner<sup>41</sup> outlines a similar operation, to him credit for this method of conservation of ovarian and uterine function justly belongs.

Wiemann<sup>42</sup> analyzes the results of the Adam's operation for retroversion in 1005 cases with a failure in 2.3 per cent. Hurd<sup>43</sup> outlines the operative results obtained in this condition in The Womans' Hospital of New York. Anatomic cures were obtained in 96 per cent, with 4 per cent failures, grouped under sterility. Schauffler<sup>44</sup> discusses the many causes of prolapse of the uterus with an analysis of the advantages of the various proposed operations. Douglas<sup>45</sup> considers an acquired retroversion or retroflexion as pathologic, contrary to the opinion of many gynecologists that these malpositions produce no symptoms. In certain types of prolapse of the uterus, Mayo<sup>33</sup> strongly favors the Kocher fixation operation. Uterine prolapse associated with spina bifida is discussed by Noyes.<sup>45</sup> Fraenkel<sup>46</sup> in his operation for genital prolapse emphasizes suspending the vagina as more important than the fixation of the uterus.

References to the many other papers on malpositions, and endocervicitis of the uterus have been omitted as adding very little to our present knowledge.

#### MENSTRUAL DISORDERS

The general accepted theory of the human reproductive cycle, which is based on the work of Fraenkel, Hitchmann, Adler, and a number of clinical workers led by R. Meyer and Schroeder, is as follows: Ovulation occurs regularly at about the middle of the interval between two menstrual hemorrhages. It is followed by the development of a corpus luteum which causes changes in the endometrium (premenstrual changes). If a fertilized ovum does not become embedded, the corpus luteum retrogresses and the premenstrual uterine mucosa breaks down and is discharged.

Experiments and observations on monkeys (*Macacus*) extending over a six year period, made by Corner,<sup>47</sup> have failed to confirm this theory. In a study of eleven monkeys, five of them were found to comply perfectly with the current theory of the human cycle quoted above. The other six monkeys showed no recent or impending ovulation preceding menstruation. It appears that menstruation in the monkey may occur without ovulation. If it could be conclusively shown that no pathologic lesions existed in the pelvic organs of these six animals, and additional evidence be added, it is evident that our present-day notion concerning menstruation will have to be completely modified. However, Robt. Meyer<sup>48</sup> considers the uteri of these animals to be pathologic. In a recent paper<sup>48</sup> he ascribes the degeneration of the central portion of the corpus luteum to a cessation of activity of an unimpregnated ovum.

It should be borne in mind that these observations of Corner are in partial agreement with the observations and conclusions of Heape recorded more than thirty years ago. Recently Allen<sup>50</sup> and Hartman<sup>51</sup> have published similar findings. But as everybody knows the final chapter on menstruation has not been written, and we are, in fact, still fairly ignorant of the reasons or purposes of this function. Sellheim<sup>52</sup> maintains that the cyclic changes in woman's organism represent the regular and complete type of evolution and, in a sense, a continuation of the working of the basic biogenetic law. This view has given rise to Aschner's theory<sup>53</sup> that deleterious alterations occur in the blood as a consequence of hysterectomy or of amenorrhea from other causes. Köhler<sup>57</sup> with other leading gynecologists, however, asserts that this theory is not proved and is at variance with actual facts. Whitehouse<sup>54</sup> has repeated Halban's experiments and maintains that the corpus luteum and graafian follicle contain an active principle which prevents necrosis of the endometrium. Allen, Compere and Austin<sup>55</sup> have been able to control idiopathic menstrual bleeding with parathyroid extract. Even though we grant the action of the other ductless glands on the menstrual cycle, this assumption does not offer the slightest clue to the causes of menstruation or explain its definite relation to the other ductless glands.

Bohnen<sup>56</sup> has confirmed Schröder's conception that there is a shedding of the spongy and compact layers of the mucosa during menstruation. O'Leary and Culbertson<sup>57</sup> have shown that the mucosa is regenerated by an upward growth of the basal glands. Klaus<sup>58</sup> believes that split products of choline play an important rôle in preventing menstrual blood from clotting.

Clow<sup>59</sup> encourages exercises and the routine daily activity among adolescent girls, and finds that less than 10 per cent have menstrual troubles under this régime. Paton<sup>60</sup> doubts if this practice is one of wisdom during the menstruation even though a certain percentage of girls appear to be improved by exercise.

Meigs<sup>61</sup> is of the opinion that myxedema and other thyroid disturbances are etiologic factors in excessive benign uterine bleeding. Gardner, Hill and Smith<sup>62</sup> believe that menorrhagia is a constant symptom of myxedema. Rongy<sup>63</sup> strongly advocates the treatment of menstrual disorders with roentgen rays.<sup>64</sup> Neill<sup>65</sup> employs radium in cases of uncontrollable adolescent bleeding. Friedlaender,<sup>66</sup> in a very excellent discussion of functional diseases of the female organs, em-



phasizes that many of the menstrual disorders are the result of our present social laws. Under the existing order of our social life, women are prevented from permitting their sexual organs to function in accordance with their structural purpose.

#### MYOMA

It has been estimated that myomas are responsible for from 4 to 10 per cent of all gynecologic anomalies, but the actual figure probably is much higher because not all myomata cause symptoms and, therefore, may be overlooked. These tumors consist of smooth muscle and fibrous tissue but the relative amount of each tissue is subject to great variations. It should be remembered, however, that no matter how great the quantity of either one is, muscle actually represents the primary constituent of the growth. Several theories as to the origin of myoma have been advanced, but none is as yet firmly established. While it seems probable that these tumors in general arise from abnormal portions of the myometrium, yet there is much evidence to show that they originate from the musculature of the blood vessels. Constitution and heredity are undoubtedly important etiologic factors. Another factor, often overlooked, is that perverted ovarian function might cause a disturbance of uterine function aside from that expressed in a menstrual disorder. Too often fibroids are looked upon solely as a local disease of the uterus rather than a definite insufficiency of the body together with a predisposition to alteration localized in the uterus. Kehrer has rightly pointed out that abnormal sexual intercourse such as coitus interruptus probably is a frequent exciting cause of myoma. Henkel<sup>69</sup> believes that the increase of menstrual flow may be accounted for by the increased surface of the uterine cavity.

Burnam<sup>70</sup> describes the "bleeding case" as one in which the abnormal uterine bleeding cannot be ascribed to a demonstrable gross pathologic lesion. This bleeding is probably most often dependent upon ovarian or pluriglandular dysfunction or blood dyscrasias. Burnham estimates that 80 per cent of small fibroids and 50 per cent of the large myomata disappear under proper treatment. Werner<sup>71</sup> has observed that animals subjected to radiation were more likely to abort and that there were more deformities in the offspring in the second generation, which should make us apprehensive of a possibility of similar effects in the human species. Paroli<sup>72</sup> has utilized the x-ray to determine the topography of tumors in relation to the uterus. The incidence of carcinoma of the uterus associated with fibroids has been variously estimated from 2 to 8 per cent. This fact should not be neglected in the choice of operations for fibroids. Although many operators prefer total hysterectomy for fibroids on account of the danger of a carcinoma developing in the cervical stump, Kahn<sup>73</sup> logically points out that the higher immediate mortality of the radical operation will often offset the advantages of possible prevention of a subsequent cancer. Toth<sup>74</sup> reports unusually good results in 447 abdominal operations for fibroids with a mortality of 0.84 per cent. Masson<sup>75</sup> believes that total hysterectomy should be performed by the experienced surgeon in all cases where removal of the uterus is indicated. Rigano-Irrera<sup>76</sup> reports three cases of sarcoma developing in myomata of the body of the uterus.

## ADENOMATOSIS

Since the epoch-making work of Sampson on perforating hemorrhagic cysts of the ovary and their relation to pelvic endometrioma, great interest in the origin of these adenomas is evidenced from many quarters. In a more recent publication on endometrioma, Sampson<sup>77</sup> has suggested the implantation of endometrial tissue by menstrual blood, either escaping from endometrial foci in the ovary, or passing from the uterus through the fallopian tubes. This latter source of dissemination will require further proof in spite of the fact that endometrial particles have been found free in the lumen of the tubes. Novak<sup>78</sup> in a study of ovarian metastasis from a primary carcinoma of the uterine body has often observed free cancer masses in the lumen of the tube, but interprets this finding as a downward movement toward the uterus rather than upward toward the peritoneum. With more careful study of lymphatics the so-called "implantation" and "contact infection" by newgrowths is viewed with increasing skepticism by many pathologists. However, one should not gain the impression that contact implantation does not, or cannot, occur in malignancy, but might conclude that this mechanism of metastasis is less frequent than heretofore considered. It should be borne in mind that Sampson<sup>79</sup> concedes that his implantation theory does not in all instances explain the presence of ectopic endometrium-like tissue in the pelvis, but that menstruation is one of the means of dissemination of endometrial tissue. Other workers place more emphasis on the differentiation of celomic epithelium in accounting for endometrial tissue in the ovary and peritoneum.

Some authorities have questioned the viability of cast off uterine endometrium and its ability to continued growth. Cron and Gey<sup>80</sup> find that the menstruating endometrium is not only viable but can be cultivated in tissue cultures. Cultures of these transplants were carried on for over a month, although it should be noted that no increase in the mass of the tissue occurred with this method of cultivation.

One of the most striking facts in the wide distribution of these endometrial growths is the lack of any authentic cases observed in the male. If the origin were due to differentiation of celomic epithelium, it seems that occasional cases should be encountered in the male just as chorioepithelioma is found in the male testis. Schmitz<sup>81</sup> reports ectopic endometrium in the ovary and inguinal canal and suggests its origin as possibly due to a metaplasia of the capillaries. This theory, while interesting, will require additional proof before it can be accepted. Pure morphology of cells is so misleading that much care should be exercised in interpretations based merely on the appearance of cells.

Heany<sup>82</sup> emphasizes the importance of pain in old abdominal scars which should arouse suspicion of endometrioma. This is clearly demonstrated in one of his cases. Schwartz<sup>85</sup> reports similar findings. Schochet<sup>83</sup> found an endometrioma in the appendix, and Köhler<sup>84</sup> in the umbilicus. These represent comparatively rare findings, since only nine other cases have been reported of endometrioma in the appendix and thirty-two instances of this growth in the umbilicus.

Graves<sup>86</sup> favors hysterectomy and removal of the ovaries in the treatment of obstructing rectovaginal endometriosis. Heineberg, on the other hand, has employed x-rays and radium in extensive endometrioma of the rectovaginal septum with satisfactory results.

## STERILITY

We are not as yet sufficiently familiar with all of the complex features of sterility to anticipate that a study of certain anatomic structures alone will reveal the actual cause of this condition. This, however, by no means implies that tubal insufflation, other patency tests or uterine lipiodol injections are without their value to the gynecologist. The patency test serves two useful purposes: first, it definitely indicates existing occlusions of the tube; second, it will exhibit the presence or absence of rhythmic contractions and peristaltic movements of the tube with the newly devised method of Rubin.<sup>87</sup>

However, there are many other possible causes of sterility that cannot be studied with this test. In this connection newer investigations on the possible relation of diet and of the recently discovered vitamin E on fertility<sup>88</sup> may prove of great importance in the sterility problem. In addition, the physiologic potency of spermatozoa, proper ovulation, effective placentation and the lytic action of semen on the mucous cervical plug must be considered. According to Kurzrok and Miller,<sup>89</sup> semen exerts a highly specific lytic action on mucin of the cervix under normal conditions.

It is most desirable that all these factors should be valued higher than the mere taking of x-ray pictures of the tubes. It must be regretted that a great number of good gynecologists seemingly have fallen into the mistake of regarding pelvic photography the most important feature in the clinical study of a sterile patient.

Polak<sup>90</sup> offers a very clear discussion of the problems of sterility and fertility in the human females. He concludes that there remain many unsolved questions and that most of our cures are merely accidental or incidental. Chatillon<sup>91</sup> is still inclined to believe that in sterility abnormal cervical conditions such as stenosis, ante flexion, inflammation, and secretory obstruction play the most important rôle. Donay<sup>92</sup> in a study of sterile women found in 24 per cent the fallopian tubes to be occluded. Jarcho<sup>93</sup> considers intrauterine injection of iodized oil as entirely safe and innocuous. Similar assertions of the harmlessness of lipiodol have been made by Secard and Forester, Randall,<sup>95</sup> and many other workers. But Hasselhorst<sup>97</sup> has seen serious results in two cases of lipiodol injection.

Moench<sup>96</sup> concludes that the compatibility test devised by Huhner is misleading and has done more harm than good because it has prevented proper inquiry in the right direction.

Grosser<sup>95</sup> from a study of artificial insemination deduces that ovulation takes place between the seventh and eighth day in those cases in which the sexual act can take place, but between the fourteenth and sixteenth day in instances where coitus has not been performed.

Unfortunately it is impossible to discuss at this time with any degree of certainty the exact rôle played by the ductless glands in sterility. There is, however, an abundance of clinical evidence to indicate the important influence of certain ductless glands on the function of the pelvic organs. Robert Frank<sup>99</sup> gives a very interesting outline of a group of cases in which sterility is due to endocrine disturbances.

## EXTRAUTERINE PREGNANCY

Dannreuther<sup>100</sup> terms extrauterine pregnancy "the enigma," and lays special stress on the many etiologic factors that produce this condition. Gonorrhea, pelvic peritonitis and puerperal sepsis are the

chief causes in the order given. Most tubal pregnancies are ampullar or isthmic. The cardinal symptoms of ectopic gestation are delayed menstruation, attacks of pain with sudden onset in one of the lower abdominal quadrants, bloody vaginal discharge, a unilateral tender mass near the uterus, and collapse of the patient. Cullen's sign of discoloration of the umbilicus is only occasionally encountered. The leucocyte count rises in direct proportion to the amount of intraperitoneal bleeding, it is a very valuable guide in the prognosis and is the best index for surgical interference. It should be borne in mind that, while this is a surgical condition, there undoubtedly are cases of extrauterine pregnancy in which the tubes rupture and the hematoma is absorbed without operative interference.

Horowitz and Kuttner<sup>101</sup> were not able to demonstrate an increase of bilirubin in the peripheral blood in cases of ectopic pregnancy as compared with other gynecologic patients. These observations are of significance in view of repeated assertions in medical literature concerning the value of blood examination in the diagnosis of intraperitoneal hemorrhages. Macias<sup>102</sup> has noted amenorrhea in only 20 per cent of patients with ectopic pregnancy.

Many etiologic causes are ascribed to extrauterine pregnancy, but with careful analysis of the cases, infection appears to be the most common. Pritzi<sup>104</sup> has found plasma cells in every one of 100 cases of tubal pregnancy, and in Kermauner's clinic the number of tubal gestations has more than doubled since the war. Such findings speak strongly in favor of an inflammatory origin rather than for a congenital cause.

There exists some divergence of opinions as to the relative frequency of ovarian pregnancies. Vineberg in a careful search of the recent literature accepts 56 authentic cases up to September, 1926. This is at variance with Dorsch's statistical study of 92 cases in 1924. Stein and Leventhal<sup>103</sup> record a case in a para iii, aged twenty-nine, with symptoms simulating acute appendicitis. Micholitsch<sup>105</sup> reports a full-term ovarian pregnancy. Schumann, in 1901, and Veit, in 1903, have carefully reviewed the question of the primary abdominal pregnancy and concluded that exact proof of its actual occurrence has not been furnished. Maxwell<sup>108</sup> et al record a case of supposedly primary abdominal pregnancy. Daly<sup>106</sup> and Silverstone<sup>107</sup> report cases of intraabdominal pregnancy with the placenta attached within the uterus and in culdesac. It is likely that a careful study of a seemingly primary abdominal pregnancy will demonstrate that it represents only a condition secondary to a ruptured tubal, ovarian or uterine pregnancy.

#### MALIGNANCY

There is no more interesting and more important chapter in the entire realm of medicine than the elusive cancer problem. In spite of the vast amount of experimental research that has been devoted to the study of newgrowths, we have not been able to break through the walls of this prison. The etiology of cancer continues to remain a hidden secret.

The mechanism of cell differentiation and cell multiplication appears to hold the key to these prison walls. Whether this stimulus to cell multiplication<sup>109</sup> (hyperplasia) in acute infections, tumor formation, and normal cell growth is similar, has not as yet been demon-

strated. Studies along these lines of investigation will require more intimate knowledge of the details of internal cell structure and function, and of normal cellular activity than routine morphologic histology so far has revealed.

Studies in biochemistry and especially of physical chemistry on cytobiology (the biology of the cell) are destined to play the future important rôle in explaining malignancy. Minot<sup>110</sup> and his associates have found a stable substance in the liver extract which has the power of stimulating the multiplication of cells manufactured by the bone marrow. It is evident that contributions of this type serve to enlarge the field for further investigations and knowledge of cell life.

It is not possible within the space allotted to a review of this type to properly evaluate the many constructive papers on the cancer problem, or even to cite the references of these contributions published during the past year. I wish, however, to call attention to the proceedings of the International Symposium on Cancer<sup>111</sup> held under the auspices of the American Society for the Control of Cancer.

#### OVARY

Fraenkel<sup>117</sup> gives a very interesting picture of the function of the corpus luteum and its relation to the other endocrine glands. All the processes that lead to the insertion of the impregnated ovum and the cyclic hyperemia of the uterus are considered as dependent upon the corpus luteum. Graves<sup>113</sup> presents a very clear and concise exposition of ovarian therapy and discusses the many causes of its failure. He emphasizes the importance of employing only fresh gland preparations and especially of the whole ovary or ovarian residue. These substances have been found to be more efficacious than those of the corpus luteum alone, since they contain the more highly potent hormone from the follicular apparatus and are free from toxic and inhibitory elements that contaminate the corpus luteum.

Shaw<sup>114</sup> discusses the mechanism of ovulation in the human under normal and abnormal conditions. The views expressed are very similar to the experimental data obtained by Clark on the preformed stigmata. Schochet in 1915 presented a different view on the mechanism of ovulation. This author claimed that the rupture of the follicle was due to an enzyme in the follicular fluid.

Failures with ovarian therapy have been variously interpreted as due to impure and nonpotent hormones. Many investigators believe that the lipid free hormones are little more than useless in therapy. Dickens, Dodds and Brinkworth<sup>115</sup> claim to have obtained a very potent aqueous hormone from the placenta. The presence of ovarian hormone substances has been definitely established by Frank et al and has been confirmed by many workers in this field of research. Smith<sup>116</sup> notes concentration of the hormone product in the blood of pregnant women. Mirvish and Bosman<sup>117</sup> have observed that the administration of follicular hormone causes a constant fall (about 35 per cent) in the calcium content of the blood. It is suggested that this test be employed as a means of standardizing follicular hormone.

Heyn<sup>118</sup> failed to note any change in the basal metabolism due to the menstrual cycle, and concluded that the alterations noted were actually caused by thyroid disturbances. Robinson<sup>119</sup> discusses the effect of radiation on the ovary and deplors the fallacies that have crept into literature concerning its deleterious effect on the offspring.

Blair-Bell<sup>120</sup> rightly emphasizes the importance of conservation of ovarian function as the keynote for treating ovarian lesions.

Brigham<sup>121</sup> describes the comparatively rare ovarian lesion of complete calcification. Papin<sup>122</sup> found calcareous concretions in an ovary causing symptoms which closely resembled ureteric calculi.

Fraser<sup>123</sup> presents a very interesting paper on the relation of the ovary to osteomalacia, but withholds final conclusions as to the exact rôle played by the ovary in the causation of this disease.

Many rare tumors of the ovary have been recorded in the literature of the past year. Wolf<sup>124</sup> reports a luteoma, and a multiple ovarian fibroma.<sup>125</sup> Keene, Pancoast and Pendergass<sup>126</sup> analyze the problem of carcinoma of the ovary, and Jarcho<sup>127</sup> discusses the practical problems of Krukenberg tumors.

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## Selected Abstracts

### Gynecologic Operations

Constantini, Henri: Upon a Point of Operative Technic in the Baldwin Operation. *Présse Médicale*, 1924, Oct. 4, p. 798.

The author notes that in 90 cases of this operation collected by Rivière there were 15 deaths, a mortality of 17 per cent. Following an operation in which he assisted his chief, A. Schwartz, the excluded coil became gangrenous, but the patient recovered. Rivière found that in the 15 fatalities collected by him peritonitis was responsible for 12 deaths, and in 9 of these the peritonitis was due to intestinal gangrene. This possibility is a serious argument against the operation, but Constantini feels that we are not justified in refusing the operation to a woman who demands relief for this condition of absent vagina.

Feeling that this gangrene could only be due to defective vascularization consequent upon section of the mesentery (which Rivière proved by dissection of 18 cadavers to be useless for the purpose of further mobilizing the coil), the author devised the following technique: The most dependent coil is chosen and its summit (25 to 40 cm. from the cecum) is pierced by a stay suture. A segment about 25 cm. long is to be isolated; at each end of this segment Kocher clamps are placed, taking care that the teeth of the clamps reach only to the mesenteric insertion. The intestine is sectioned and the four ends are turned in by purse-string sutures. A lateral anastomosis is then performed, leaving the mesentery of the excluded coil absolutely intact and rolled up behind the sutured intestine. The results as far as intestinal function is concerned are as good as after an end-to-end anastomosis, if the stoma is sufficiently large. Two patients have so far been operated upon by this method; one by Rosenthal and one by the author, with a satisfactory outcome in each instance.

E. L. KING.

Schubert, G.: Construction of a Vagina by my Method Followed by Conception and Labor. *Medizinische Klinik*, 1927, xxiii, 1334.

Schubert believes his operation of constructing a vagina is indicated regardless of whether a normal uterus is absent or present. In the former cases, the absence of a vagina is a congenital anomaly whereas in the latter cases it is an acquired phenomenon due to diseases such as diphtheria, scarlet fever, etc., or to trauma such as may occur during labor or operation. Among twenty-one women with congenital absence of the vagina operated upon by Schubert one had a functioning uterus. The Baldwin-Mori-Haberlin operation for constructing a vagina has a mortality of 17 per cent according to the most recent statistical study. The Schubert operation which utilizes the large instead of the small bowel has a mortality of only 3.2 per cent in a series of ninety-five cases reported in literature.

Wagner reported a case in which after a Schubert operation the patient had three deliveries, the first of which was by means of forceps and the other two spontaneous. Schubert insists that there are ethical reasons for performing the operation of constructing a vagina and cites a few instances where women committed suicide because they thought their condition was hopeless. Absence of the vagina does not necessarily mean that libido is absent.

J. P. GREENHILL.

Ott, D.: Disinfection of the Vagina is Indispensable in all Gynecological as well as Obstetrical Cases. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxx, 257.

Ott believes that the vagina can be sterilized much more readily than the skin because the latter has sweat and sebaceous glands which make disinfection impossible. In 430 cases of carcinoma of the uterus operated upon vaginally the author's mortality was 1.8 per cent as compared with 8.9 per cent of Schauta and a still higher mortality of Wertheim. This result the author attributes to preoperative disinfection of the vagina. The procedure employed is as follows: After shaving, the external genitalia are scrubbed with brushes. The vagina is energetically rubbed with soap on the fingers and then irrigated with a 1-2000 solution of bichloride of mercury to remove the mucus and soap. Finally the vagina and cervical canal are painted with iodine which produces a sterility of 100 per cent. In a series of 2000 abdominal and vaginal operations for fibroids where this technic was used there was not a single death. Since instituting the above procedure in his obstetric practice the author has not had a single case of sepsis. In the last four years among 1313 cases of abortion there was not a single death and not a single case of sepsis. The author insists that the vagina should be disinfected in this manner during every labor and before every gynecologic operation.

J. P. GREENHILL.

Radoulovitch, Geo. M.: The End-Results of Conical Excision of the Uterine Cervix in Endocervicitis. *Presse Médicale*, Aug. 16, 1924, p. 684.

The author recommends, in treating endocervicitis, the use of the Filhos cautery which gives excellent results in the majority of cases. Three or four treatments at ten day intervals usually suffice. This method might be followed by cicatricial stenosis, which should be avoided if a careful technic is employed. In case this treatment fails, conical excision of the endocervix by the Sturmdorf method is recommended as preferable to the Schroeder operation formerly the favorite in France.

The technic is described and the excellent results, subjective and objective, noted in three cases examined three years after operation, are stressed. The author prefers this operation for the following reasons: (1) primary union is the rule;



(2) the endocervical mucosa is removed in toto; (3) perfect hemostasis and freedom from postoperative hemorrhage are assured; (4) the circular fibers of the cervix are preserved, hence in case pregnancy supervenes dilatation should proceed normally during labor. So far no pregnancy has followed the operation, as all the patients were past forty. The author is considering the advisability of employing the operation in treating this condition in younger women.

E. L. KING.

**Mayer:** Remarks on the Remote Disturbance of Fundal Hysterectomy. *Bruxelles Médical* 1927, vii, 434.

The observations made by Mayer are based on a follow-up of twenty cases in which fundal hysterectomy had been done. In about one-third of these cases the menstrual period remained normal and regular. Twice following this procedure there was sufficient menorrhagia to necessitate radiation. In many cases the leucorrhea and dysmenorrhea persisted. Again, pain continued to such a degree as to necessitate a second operation with radical removal of the remainder of the pelvic organs. In one instance a large ovarian cyst which necessitated removal formed within six weeks of the fundal hysterectomy. Mayer does not feel that leaving one ovary with sufficient endometrial tissue necessarily ensures the continuation of menstruation. On the other hand, even where both ovaries must be removed, he does not advocate hysterectomy in all cases, feeling that the fundus, if small and normal, can often be left with advantage. Fundal hysterectomy finds its greatest field in the treatment of certain types of fibroid tumors of the uterus.

THEODORE W. ADAMS.

**Holtz, F.:** The Results of Conservative and of Operative Treatment in the Chronic Phase of Salpingo-oophoritis. *Acta Obstetrica et Gynecologica Scandinavica*, 1926, iv, 347.

A study was made of 1597 cases of salpingo-oophoritis, 80 per cent of which were reexamined after a period of observation of one to six years. Among 1072 cases of salpingitis treated conservatively, 877 or 82 per cent were examined at a later date and of these 82 per cent had no recurrence and were perfectly able to work. Of 175 patients in whom pregnancy was possible, 47 or 27 per cent became pregnant. In the cases where the affliction had been unilateral, the incidence of pregnancy was 35.5 per cent and in the cases where it had been bilateral, it was 20 per cent.

Among 321 patients upon whom operation was performed, 2 died, a mortality of 0.6 per cent. Of 267 patients examined after operation, 61.5 per cent were completely cured and 91.5 per cent were capable of working.

The author concludes that in the large majority of cases of salpingo-oophoritis, treatment should be expectant and conservative but where this fails, operation is indicated. In febrile cases operation should be done when there seems to be a localized abscess, a general peritonitis, or a septic infection limited to the adnexa which does not yield to conservative therapy. Operation is also indicated in febrile cases when the diagnosis is not certain, especially when appendicitis is suspected, and in cases of chronic infection when the life of the patient is menaced.

In afebrile cases one should operate where there is constant pain, recurrence of symptoms unless these again subside rapidly, and when one suspects tuberculosis, extrauterine pregnancy or malignant tumors. During the operation we should be very conservative.

J. P. GREENHILL.

Mannheim.: Operative Treatment of Salpingo-oophoritis. Zentralblatt für Gynäkologie, 1925, xlix, 1471.

The present tendency is to operate only after three separate attempts at cure, each lasting approximately 12 weeks, and then only with due regard to other conditions particularly in reference to child bearing. The author reports the results of 294 cases in the last 10 years, and compares the results of radical with conservative operation. In 43 per cent the etiology of the condition was not definite, but gonorrhea seemed definitely responsible for 50 per cent, septic infection for approximately 6 per cent, and tuberculous infection 1.4 per cent. He believes with Asch that only complete removal of the diseased internal genitalia allows of complete cure in cases due to gonorrhea. As complication of operation the most frequent was infection of the abdominal wound, 7 per cent of the cases, while exudate from the stump was noted in 6.3 per cent, abscess formation in 2.5 per cent, intestinal and bladder fistulas in 2 per cent, and lung conditions in 1.5 per cent.

Mannheim concludes that radical operation gives a greater per cent of cures than does conservative operation though the average duration of treatment is longer in cases radically operated upon. Secondary operations are relatively frequent in those operated on conservatively.

The mortality is relatively the same in both forms of treatment and there is no difference in the frequency of resultant complications, but subsequent examination shows markedly better permanent results in those radically operated upon. A stormy menopause is relatively more likely after operation in the young than in the old, but is not to be considered as a contraindication. On all points the evidence is overwhelming in favor of radical as opposed to conservative operation.

LITTLE.

Fothergill, W. E.: Development of Vaginal Operations for Genital Prolapse. British Medical Journal, Feb. 13, 1926, p. 273-274.

In 1831 Marshall Hall of London devised an operation which was performed for him by Heming. A large portion of the anterior wall was denuded between the cervix and the vaginal outlet. The margins of the wound were then sutured. In 1844, Killian operated by means of the triangular denudation of the anterior vaginal wall with the base toward the cervix. In 1866, Sims similarly excised an oval portion. Savage in 1858, Aveling in 1866, and Morton in 1869 used incomplete methods. Thomas, in 1872, made a small incision through which he inserted a blunt instrument to separate the bladder from the anterior vaginal wall. After that, anterior colporrhaphy became a recognized operation.

In 1848, Huguier did a high amputation of the cervix by means of the scalpel. In 1866, Sims amputated the cervix closing the wound with sutures. Schroeder's operation then came into use.

Perineorrhaphy and colpo-perineorrhaphy seem to have been first developed sufficiently by Guillemeau, pupil of Paré. Dieffenbach published his work on perineorrhaphy in 1829. Roux followed in 1834 and Baker Brown in 1851. In 1832, Fricke united the labia majora and called the operation "Episiorrhaphy." This later developed into perineorrhaphy and colpo-perineorrhaphy. Simon did a "Kolporrhaphia posterior" in 1867. In 1864, Emmett denuded and sutured an oval portion of the posterior vaginal wall at one sitting, repairing the perineum at another. He combined the two operations in 1880.

From 1874-1881, Hegar developed the operation to somewhat like its present form. Garrigues was the first to recognize the value of this operation for rectocele and not for uterine prolapse. Present-day operations have been developed from these beginnings.

L. A. STELTER.

**Schubert, G.:** The Operation for Prolapse and Fixed Retroflexion of the Uterus. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1926, lxxv, 69.

Twelve years ago, the author described an operation which fixed the uterus in an anterior position by means of a transplanted band of fascia. He formerly used a piece of fascia from the fascia lata but now uses a preparation of the pericardium of an ox. The operation is carried out as follows: After performing the necessary cystocele and rectocele operation, the abdomen is opened. The middle of the piece of fascia to be used is sewn to the uterus at the insertion of the uterosacral ligaments. The inguinal canals are then pierced with clamps and the free ends of the fascial strip are pulled through these canals. The uterus is drawn up into an anterior position and the fascial ends sewn to each other over the fascia of the recti muscles.

Of the 100 patients operated upon by this method, 92 were traced. Two of the patients died soon after the operation, one on the day after operation of hemorrhage and the other on the 12th day of embolism. Among the remaining 90 there was not a single recurrence even though 15 of them had gone through a pregnancy. In all the examined women, the uterus was anteфлекed. The advantage of this operation is that in addition to its assurance against a recurrence, it can be performed at any age without regard to the reproductive function of the patient.

J. P. GREENHILL.

**Benthin, W.:** Prolapse Therapy. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1927, lxxv, 384.

In mild cases of prolapse of the uterus, Benthin advocates the Alexander-Adams operation regardless of age, but the uterus must be movable and not abnormally enlarged. If there is weakness of sphincter control, and the patient is near or past the menopause, a vaginal fixation operation should be performed. Where the uterus is very large, neither of these operations should be done. In such cases the cervix should be fixed to the abdominal wall after amputating the body of the uterus. In cases of marked descensus with cystocele formation, and in cases of actual prolapse, the type of operation to be performed depends upon the age of the patient. In patients who are in the reproductive period, an abdominal cervical fixation should be done but in women past the menopause, this operation or an interposition operation may be performed. The latter operation should be done only when there is advanced sphincter weakness.

J. P. GREENHILL.

**Bonney:** An Operation for Creating an Abdominal "Shelf" in Certain Cases of Visceroptosis in Women. *Lancet*, 1926, cxxi, 487.

The symptoms complained of by patients suffering from this form of visceroptosis are a sense of weakness preventing any prolonged exertion; backache, and pain referred to the lateral parts of the lower abdomen in the region of the appendix and cecum on the right side, and the point where the colon crosses the pelvic brim on the left side. This pain which is evoked by standing and exertion, and which disappears with recumbency is probably due to a drag on the ovario-pelvic ligaments.

The writer feels that the downward extension of the peritoneal cavity plays an important part in the mechanism of defecation because it permits pressure to be brought to the upper part of the rectum by the intestinal coils forced into the pouch during straining.

The operation is a combined operation for direct ventrofixation and round ligament shortening. A puckering suture is run along each round ligament starting

about an inch from the point where the ligament leaves the abdominal cavity and ending at the attachment of the ligament to the uterus. The suture should be passed through the ligament itself. The ends are then tied and left long. These long suture ends are then carried out through the internal inguinal ring between the external rectus sheath and the rectus muscle toward the line of incision, much as is done in the suspension operation when the round ligament is brought through the internal inguinal ring and between the rectus sheath and muscle. Traction of these sutures pulls the pleated part of the round ligament against the abdominal wall to which they are subsequently fixed by passing the two ends of each suture through the aponeurosis at either side and tying them there. The uterus itself is now attached by passing two silk sutures through the upper anterior wall and through the aponeurosis and peritoneum on either side of the wound. Before tying, a mattress suture is taken on either side between the peritoneum of the anterior abdominal wall and the region of the cornua of the uterus.

This procedure results in the formation of a partition running transversely across the abdominal cavity entirely separating it from the uterovesical space. This partition in a standing posture forms a shelf on which the intestines rest. The intestinal pressure is directed downward and backward into an opened culdesac or Douglas' pouch.

NORMAN F. MILLER.

**Beuttner, Oscar:** The Examination of the Appendix and the Indications for Appendectomy in the Course of 1400 Gynecologic Laparotomies. *Presse Médicale*, 1924, No. 97, p. 958.

In this series, the appendix was not inspected in 121 cases. In the others, it was macroscopically normal in 1063 instances and macroscopically abnormal in 216; all in the first group were left in situ, while some of the latter group were excised. One hundred of these excised appendices were studied histologically; of these, 63 were found to present lesions, while 37 were normal. In only four of these 100 cases did the author consider that appendectomy was absolutely indicated. He found very little correspondence between the macroscopic appearance and the microscopic picture, so that in difficult cases he does not hesitate to leave the appendix, even though it is macroscopically altered. He would consider the removal of an appendix presenting little or no macroscopic change only if the history pointed definitely to past appendiceal trouble, or if the patient insisted on its excision.

The author, in eighteen years, has never encountered a case of appendicitis in a patient previously subjected to gynecologic intervention. He feels that routine appendectomy in the course of gynecologic laparotomies is not justified, on account of the additional risk (even though slight). Furthermore, he is not as yet convinced that the appendix has no function.

E. L. KING.

**Faure, J. L:** Appendicitis Again! *Presse Médicale*, 1924, No. 101, p. 1001.

Faure vigorously protests against Beuttner's conclusions, in his article in the same journal two weeks previously. Faure contends that the French gynecologists, being general surgeons as well, have occasion to examine many more appendices than gynecologists of the German school, to which Buettner belongs. Consequently, the opinions of the former, based on numberless observations, are of more value than those of the members of the latter school. The author also lays more stress on a careful macroscopic study of the whole organ, splitting it from end to end, than on a microscopic examination, in which one or two slides are examined. He feels that four-fifths, or even nine-tenths, of the appendices encountered in abdominal work are altered and diseased, and should be removed if this can be done without subjecting the patient to serious risk.

E. L. KING.

Watkins, Thomas J.: Vesicovaginal Fistula. Utilization of Thorough Dissection of the Anterior Vaginal Wall for Closure. *Surgery, Gynecology, and Obstetrics*, 1925, *xl*, 274.

Closing vesicovaginal fistulas through dissection of the anterior vaginal wall, always gives a good exposure, supplies a maximum amount of mobilization and conserves tissue. Retraction and fixation of the injured tissues in chronic cases is an important factor in the pathology and the operative treatment, especially when the sphincter is involved. Deep lateral dissection and firm suture may establish urinary continence in cases in which the sphincter seems to be irreparably damaged.

With this article there are five illustrative plates which thoroughly demonstrate has excellent sphincter control.

WM. C. HENSKEL.

Darner, H. Laurant: An Operation for Rectovaginal Fistula Complicated by a Third Degree Tear. *Surgery, Gynecology and Obstetrics*, 1927, *xliv*, 105.

The cutting across of the remnant of the perineal body as a primary step in operations on lesions of this type is a rather radical procedure inasmuch as it destroys the one intact structure bridging the defect. In the case reported it served so admirably as an anchorage for the anterior rectal wall that its preservation was of the utmost importance. In view of the marked mobility of the anterior rectal wall and the fact that there is often a rectocele pouch as in the present case, the rectum as far as the upper margin of the fistulous tract can be drawn down without the slightest tension.

Beginning at the lower margin of the carunculae myrtiformes on each side an incision was made along the mucocutaneous border as far as the level of the sphincter dimpling. It was then carried around the upper border of the fistulous tract, care being taken to incise only the vaginal mucous membranes. A pair of iridectomy scissors was found of the utmost value in doing the finer dissection about the fistulous tract. By keeping lateral to the midline scar tissue band the lateral vaginal and rectal walls were easily separated by blunt dissection well up into the rectovaginal septum. Along the course of the scar tissue band, the rectum and vagina were so adherent that a definite line of cleavage could not be found and the dissection had to be done very carefully by sharp dissection. The upper edge of the fistulous tract in the rectum was now freshened by cutting away a few millimeters of the edge. Two Allis clamps were then passed through the anal orifice and the upper edge of the fistulous tract in the anterior rectal wall grasped and drawn down to the anal orifice. This could be done with absolutely no tension. The under surface of the intact perineal bridge was then denuded of mucous membrane and the drawn-down rectal wall sutured to the anterior portion of the anal orifice by means of numerous interrupted sutures of No. 00 chromic catgut.

The perineum was again cleansed and posterior colporrhaphy and suture of the sphincter muscles carried out. The levator muscles and fascia were then drawn together with three figure-of-eight sutures of No. 3 chromic catgut, each of these sutures being caught in the anterior rectal wall so as to relieve an unnecessary tension on the site of the rectal sutures. The redundant vaginal mucosa which included the vaginal opening of the fistula was then excised and the cut edges, together with the superficial perineal muscles and fascia, drawn together with several continuous sutures of No. 2 plain catgut.

Defecation was prevented during the first 10 days. The perineal incision, except for a few superficial areas of separation, has healed by first intention. On the eleventh day she was given a large retention enema of olive oil. At the same time she was given mineral oil by mouth followed the next morning by a saline cathartic. Twelve hours later, there was a copious semi-solid stool. The patient since operation the operative technic.

WM. C. HENSKEL.

**Maiss:** *Fistulas After Vaginal Extirpation of the Uterus.* *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxix, 90.

Vaginal extirpation of the uterus is attended by more complications than any other gynecologic operation. Among 583 vaginal panhysterectomies, the author had a primary mortality of 2.4 per cent and six fistulas, of which four were ureteral, one a rectovaginal and one an intestinovaginal. The bladder was injured a number of times but in no case did a fistula result.

It is known that after the occurrence of ureteral fistulas the corresponding kidneys undergo degeneration. This is due essentially to a slow but constant increase in pressure in the renal pelvis and to ascending infection. Atrophy of the kidney usually occurs within a few months. Because of the danger to the kidney in cases of ureteral fistulas attempts should be made to implant the ureters. Before doing this, the urine must be examined to make certain there is no damage or infection of the kidney. After implantation, the patients must be carefully observed for a period of three years, since atrophy of the kidney may occur. At operation special precautions should be taken to avoid strictures of the ureter. If implantation cannot be performed because the fistula is too high, it is best to ligate the ureter and tie a true knot in it above the ligature, because a ligature may cut into the ureteral lumen and produce a fistula. The author advocates the use of catgut rather than of nonabsorbable sutures for all fistulas.

J. P. GREENHILL.

**Hjelt, S.:** *The Treatment of Postoperative Retention of Urine.* *Acta Obstetrica et Gynecologica Scandinavica*, 1926, v, 89.

On the basis of a study of 125 cases of postoperative retention of urine, the author believes that the intravenous administration of a 10 per cent solution of urotropin is very helpful. In this series, the treatment failed in 10 cases. Marked tenesmus occurred in 4 per cent and hematuria in 2.8 per cent after the injections of urotropin. To avoid these complications, not more than 3 c.c. of the solution should be given.

J. P. GREENHILL.

**Chauvin, E., Esmenard and Jaur:** *Research on the Rôle of Blood Coagulability in the Production of Postoperative Phlebitis.* *Gynécologie et Obstétrique*, 1926, xiii, 124.

Many conflicting theories are advanced to explain the occurrence of postoperative phlebitis. Schikelé finds in the uterus and ovaries anticoagulants, to the lack of which he attributes phlebitis following removal of these organs. Fellner, on the other hand, shows that they contain strong coagulants, which, liberated into the blood stream at operation, cause clot formation.

The authors studied the coagulation time before and after operation in 25 cases, varying from simple to very radical procedures. They conclude that there is no notable change before and after, and that neither the seriousness of the operation, (excluding serious hemorrhage) nor the anesthesia, are important factors. In a study of 8 cases of postoperative phlebitis, there was a constant increase over the normal coagulability, varying from one minute to two minutes and five seconds. Control tests were made on operative cases recovering normally. These findings indicate that postoperative thrombosis, which has nothing in common in its mechanism with the coagulability of the blood, should not be attributed to increased coagulability dependent on operation.

GOODRICH C. SCHAUFFLER.

Peterson, E.: Acute Intestinal Occlusion After the Gilliam Operation. *Acta Obstetrica et Gynecologica Scandinavica*, 1927, vi, 13.

The author reports three cases of acute intestinal obstruction which occurred after Gilliam suspension operations. These three cases occurred in a series of 256 Gilliam operations performed in Denmark between 1920 and 1925. Other complications noted in this series were abdominal adhesions and severe hemorrhage after abortions in the suspended uteri. In view of these facts the author feels that the Webster and the Alexander-Adams operations are preferable because they are safer. The latter operation should be performed when it is certain that the adnexa are normal.

J. P. GREENHILL.

Markus, B.: Ileus After Ventral Fixation. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxxviii, 271.

A forty-one year old patient who had had a ventral fixation in 1916 had symptoms of acute intestinal obstruction in 1923. Laparotomy was performed and the uterus was found attached to the peritoneum by a bridge of tissue about 8 cm. above the symphysis. In the space between the uterus and the abdominal wall a piece of small intestine was compressed. The uterus which was freed from the abdominal wall was removed with the adnexa. The compressed piece of intestine regained its normal appearance and therefore was not resected. Four months later the patient had another attack of acute intestinal obstruction and a second operation was performed. A gangrenous mass of small intestine was found rotated around a scarred area in the mesentery, which had been seen at the first operation. Eighty-five centimeters of intestine were resected and the patient recovered.

The author found in the literature only eight cases of ileus after a ventral fixation but he believes many cases have not been reported. Among all the methods of elevating the uterus he prefers the Alexander-Adams operation. In multiparas this is always combined with a plastic operation on the perineum.

J. P. GREENHILL.

Ferber: Some Bad Results in Gynecologic Operations. *Medical Journal of Australia*, 1927, i, 115.

The author discusses in a very satisfactory manner the pros and cons of the more common gynecologic operations. His feeling regarding salpingectomy for inflammatory conditions is especially interesting. Thus he states that: "The prayerful expectant treatment adopted by patients or practitioners only too commonly results in the formation of pus collections in the pelvis, tubes and ovaries, adhesions, destructions of the ovaries and so on. This results in an operation of magnitude with the tissue left behind damaged both by the operation and by the inflammation." He feels further that: "The pendulum of delay has swung too far and deductions have been drawn from statistics from the point of view of mortality without sufficient consideration being made of resultant morbidity." "The time has arrived," he believes, "when we should readjust our ideas with regard to early interference at least in cases of gonococcal infection."

He feels that the bad results attributable to supravaginal hysterectomy are pain and persistence of discharge and the development of malignant tumors in the cervical stump. Supravaginal hysterectomy is only a half completed operation and the cervix should be coned out from above in every case in the absence of definite contraindications. If this cannot be done easily, removal of the cervical canal through the vagina should be performed either at the time or later as considered desirable in each individual case.

NORMAN F. MILLER.

Cooke: *A Study of the Factors Influencing Mortality and Morbidity Following Gynecologic Laparotomies.* The American Journal of Surgery, 1927, iii, 473.

Cooke deals with the problem of mortality and morbidity following laparotomy by standardizing the selection of cases, preoperative preparation, speed, and gentleness of operation, postoperative care, etc. He was able to show a mortality decrease from 1.00 per cent to 0.75 per cent where speed was reduced, and a decrease of 0.75 per cent to 0.11 per cent where gentleness was practiced. In a series of 400 laparotomies where all rules were observed the mortality rate was nil.

WILLIAM KERWIN.

White, Clifford: *Instruments Left in the Peritoneal Cavity.* Journal of Obstetrics and Gynecology of the British Empire, 1923, xxx, 601.

Immediate removal, the patient's condition permitting, is the best treatment for foreign bodies left in the abdominal cavity at operation. If removal at once is impossible or the loss of the instrument is not noted there seems to be no grave risk from a few days delay. A blood soaked sponge is more likely to cause the rapid onset of peritonitis than a solid instrument. The use of long gauze rolls reduces the likelihood of this accident. The fewer instruments, particularly small instruments, used in an operation the less common is accident. Towel clips should be replaced by sutures.

Twenty-nine of 44 foreign bodies left in the abdomen were artery forceps. Eleven of the 44 patients died. In seven of nine fatal cases the foreign body had been in the abdomen at least a year. Of the 33 cases recovering, the foreign body was removed at a second operation in 26. This operation was done within a few hours in five cases, within 48 hours in four, within a few weeks in eight cases and after six months in the remaining 16.

H. W. SHUTTER.

### Miscellaneous

Worthington, George E.: *Compulsory Sterilization Laws.* Journal of Social Hygiene, 1925, xi, 257.

Sterilization bills have been passed by sixteen states from March 30, 1905, to January 1, 1925. In seven states these laws were declared to be unconstitutional, and in other states the laws have been practically unused.

The three general types of sterilization laws are given as punitive, therapeutic, and eugenic. Legislation for sterilization is not considered as a practical measure at the present time. Dr. Fernald has shown that only 50 per cent of feeble-minded owe their defect to heredity, the rest being due to accidents of birth or infectious disease during the first two years of life. There is no proof that the 50 per cent of defectives transmit this condition to their offspring. The modern psychiatrist thinks of feeble-mindedness as a complex problem. Segregation would be unwise economically as well as socially. Legal objections to sterilization laws are that (1) they are in advance of public opinion; (2) violate the bill of rights contained in our federal and state constitutions; (3) that there is no adequate legal classification sufficiently describing persons who should be subject to compulsory sterilization; (4) compulsory sterilization of defective degenerates will prevent their segregation in institutions.

Arguments in favor of sterilization are: (1) Socially inadequate persons are a menace to the next generation. (2) The protection to future generations provided by compulsory sterilization is a sound public policy. (3) The right and duty of self defense apply to nations as well as to individuals, and nations must defend



themselves against racial degeneration. (4) Regardless of laws of heredity there are numbers of habitual criminals who should be prevented from procreating because of their unfitness for rearing children.

California is the only state in which sterilization has been used to any extent, and for the most part these operations have been therapeutic. ADAIR.

Giles: The Need for Medical Teaching on Birth Control. *Lancet*, 1927, ccxii, 165.

Authoritative teaching on the subject of birth control is necessary for two principal reasons: (1) such advice is necessary from a medical point of view in many cases; (2) the general public already knows considerable about birth control and is anxious to know more and such instruction should come from medical men.

The medical reasons for birth control are numerous. Some of them are: Heritable diseases in either parent, such as syphilis, tuberculosis, and mental disease. Diseases that make childbearing dangerous to the mother, including heart disease, tuberculosis, nephritis. Conditions that obstruct labor, including contracted pelvis, tumors or other abnormalities. Previous difficult or dangerous deliveries. Childbearing in excess of a woman's strength. Each of these reasons is discussed by the writer, as are also the economic grounds for birth control.

The writer mentions the following methods as being already adopted: Abstinence; restriction of intercourse to the "safe period"; prevention of entry of spermatozoa into the vagina or coitus interruptus; mechanical prevention of entry of spermatozoa into the uterus; chemical methods of prevention of entry of spermatozoa; surgical methods. The two main drawbacks to the general principle of birth control are the disadvantage to a country from a falling birth rate, and restrictive methods adopted in the beginning of married life, resulting in self-indulgence, selfishness, etc. The writer considers the least harmful plan that of restricting intercourse to the so-called safe period, while of the mechanical means he considers the condom as probably the least objectionable. Coitus interruptus is particularly detrimental to the woman's health. In mechanical methods the prolonged use of quinine pessaries may result in ultimate permanent sterility. Certain pessaries produce an ascending metritis and salpingitis.

It is advised that the medical profession lay down indications for birth control and point out its limitations. NORMAN F. MILLER.

Sison, H. A.: Maternal Mortality Among Filipinos. *Journal of Philippine Islands Medical Association*, 1926, vi, 321.

The rate of maternal mortality among the Filipinos is excessively high. The greatest mortality is caused by puerperal septicemia and puerperal hemorrhage, which together form 72.87 per cent. The mortality rate of puerperal hemorrhage is exceedingly high. The predisposing causes of this state of affairs are the following: (a) the faulty position the Filipino frequently assumes while at rest; (b) the inadequate care of pregnancy, labor, and especially of the puerperium; (c) the frequency of malnutrition on account of insufficient and faulty diet and lack of outdoor exercise; (d) frequent succession of pregnancies; (e) violent efforts to express the placenta before its complete separation; (f) tardy institution of proper treatment by an expert. Only 25.19 per cent of the deliveries are assisted by the physician, 19.94 per cent by the midwives, and the rest solely by the family.

Better training of physicians in obstetrics is needed. The masses should be educated in the necessity for prenatal and postnatal care, in the rudiments of asepsis, and the dangers of being assisted by ignorant persons or by half-taught, unscrupulous professionals. C. O. MALAND.

Cotte, Gaston: Has Hypogastric Sympathectomy a Place in Gynecologic Therapy? *La Presse Médicale*, Paris, 1925 (Jan. 24), p. 98.

Many gynecologic patients complain of dysmenorrhea, dyspareunia, etc., in spite of the fact that little or no pelvic pathology can be discovered on examination. Many of these so-called functional troubles bear the marks of profound alterations of the nervous system. The female pelvic organs are exceptionally well supplied with fibers from the sympathetic system, and it appears reasonable to assume that preventing reflexes from reaching the organs might cure some patients complaining of these disorders. Jabulay, in 1898, successfully operated upon two patients with pelvic neuralgia and vaginismus; in one patient he resected the sacral sympathetic chain, in the other he rolled the rectum forward, and thus tore the branches going from this chain to the hypogastric plexus. Since then, others have reported successful results following similar operative procedures.

Cotte reports in detail two cases successfully treated by him by bilateral hypogastric periarterial sympathectomy. The first patient complained of dysmenorrhea and menorrhagia; the second of menorrhagia and dyspareunia. The first cure was of fourteen months' duration at the time of the report; the second, ten months. In other instances the results have been very satisfactory, but the operations were of recent date. He feels that in some cases resection of the presacral or the hypogastric nerves will suffice, and will be much simpler of execution.

E. L. KING.

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## Item

### American Gynecological Society

At the fifty-third annual meeting held at Washington, D. C., May 1st, 1928, Dr. C. Jeff Miller, of New Orleans, La., was elected president, Dr. Charles C. Norris, of Philadelphia, first vice-president, and Dr. W. C. Danforth, of Evanston, Ill., second vice-president; Dr. Floyd E. Keene, of Philadelphia, Pa., secretary, and Dr. Fred L. Adair, of Minneapolis, Minn., treasurer.

## Books Received

OPERATIVE SURGERY. By J. Shelton Horsley, Attending Surgeon, St. Elizabeth's Hospital, Richmond, Virginia. With 576 original illustrations. Third edition. St. Louis, The C. V. Mosby Company, 1928.

GYNECOLOGY. By Howard A. Kelly and Collaborators. D. Appleton and Company, New York, 1928.

RADIUM IN GYNECOLOGY. By John G. Clark and Charles C. Norris, Philadelphia. With 49 illustrations. J. B. Lippincott Company, Philadelphia, 1928.

PATHOLOGICAL PHYSIOLOGY OF INTERNAL DISEASES. Functional Pathology. By Albion Walter Hewlett. Revised in memoriam by his colleagues, under the editorial supervision of George DeForest Barnett. With 164 illustrations. D. Appleton and Company, New York, 1928.

ANTE- AND POSTNATAL CHILD HYGIENE. By W. M. Feldman, Senior Physician to St. Mary's Hospital for Women and Children, etc. With 161 illustrations and 14 plates including over 100 portraits. John Bale, Sons & Danielsson, Ltd., London, 1927.

ARS MEDICI. The Journal of the American Medical Association of Vienna. Review and Abstracts of All Branches of Foreign Medical Literature. Edited by Dr. M. Ostermann. Volume v, 1927.

UNIVERSITY OF IOWA STUDIES. Volume III. No. 1. Published by the University, Iowa City, Iowa, 1927.

LE DRAINAGE EN CHIRURGIE ABDOMINALE. Par les docteurs F. M. Cadenat et M. Patel, la faculté de médecine de Lyon. Libraire Octave Doin, Paris, 1928.

TRAITÉ DE GYNÉCOLOGIE MÉDICO CHIRURGICALE. Par J. L. Faure et Armand Siredey. Quatrième édition, revue, corrigée et augmentée. Avec 637 figures, dont 288 en couleurs dans le texte et six planches en chromotypographie hors texte. Libraire Octave Doin, Paris, 1928.

BIOLOGIE UND PATHOLOGIE DES WEIBES. Herausgegeben von Josef Halban und Ludwig Seitz. Lieferung 41. Urban und Schwarzenberg, Berlin und Wien, 1928.

GEBURTSHILFLICHE UND GYNAEKOLOGISCHE THERAPY. Von Dr. Georg Burkhard, Professor der Geburtshilfe und Gynaekologie an der Universität in Würzburg. Verlag von Urban und Schwarzenberg, Wien, 1928.

LEHRBUCH DER HEBAMMENKUNST. Von Dr. B. S. Schultze. 16. Auflage, neu bearbeitet von Dr. v. Miltner. Verlag von Wilhelm Engelmann in Leipzig, 1928.

COMMUNICABLE AND OTHER DISEASES. Medical Department of the United States Army in the World War. Volume IX. U. S. Government Printing Press, Washington, D. C., 1928.

CARDIOPATHIES ET GROSSESSE. Le retresissement mitral. Par J. Sejourne. Avec 22 figures dans le texte et 4 planches hors texte. Libraire Octave Doin, Paris, 1928.

HANDBUCH DER INNEREN SEKRETION. Herausgegeben von Dr. Max Hirsch. III Band, Lieferung 4. Verlag von Curt Kubitzzsch. Leipzig, 1928.

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## Original Communications

### SYPHILIS AND PREGNANCY\*

BY S. A. GAMMELTOFT, M.D., COPENHAGEN, DENMARK

*(Professor of Obstetrics and Gynecology, University of Copenhagen)*

IT IS not necessary here to dwell on the general calamities attending the venereal diseases, and particularly syphilis. It is universally conceded that these diseases require the uttermost attention from physicians, public health officers, and everyone interested in social welfare. And congenital syphilis forms an especially somber chapter of this problem.

Really, no misfortune can be compared with that which falls to the lot of one, who from his birth carries the stamp of a disease which, even under the most favorable circumstances, will mark him through youth, and which if not recognized may infect many other individuals before it finally proves fatal to the unfortunate victim.

In discussing congenital syphilis, a number of questions arise: some of these are of medical nature, others—not the least important—are of social concern. I shall discuss a few of these questions in the following and attempt to show how, in Denmark, we endeavor to combat this disease.

The material on which my remarks are based comprises 1290 syphilitic women who were delivered in the Lying-In Hospital of the University Clinic of Copenhagen from 1912 to 1926. The total number of births during this period was 23,383. Thus the percentage of syphilitic mothers amounts to 5.5.

This figure agrees quite well with those reported by other European clinics. The American figures, on the other hand, vary a great deal,

\*Read, by invitation, at a meeting of the New York Obstetrical Society, November 8, 1927.

mostly, as Williams has pointed out, on account of the great difference between the white and the colored races in this respect.

It is only proper for me to mention that the results of my investigation and my conclusions on this subject were obtained in collaboration with the Dermato-Venerological Clinic of the University of Copenhagen and, particularly, from my working together for a number of years with Harald Boas, the great Danish expert on congenital syphilis and a recognized authority on serum reactions.

The problem which I desire to discuss includes the following questions:

(1) The probability of the transmission of syphilis from the mother to the fetus.

(2) The prevention of this transmission.

(3) The precautions by state and society to prevent the spread of congenital syphilis.

As to the first question, we must, to begin with, have a clear conception of how the fetus is infected.

I subscribe in all essentials to the views Matzenauer has expressed in the handbook by Seitz and Halban, *Biologie und Pathologie des Weibes*. Our material has fully confirmed the view, that *the maternal transplacental transmission is the only way of transmission or practically the only way of any importance*. Those instances of congenital syphilis in which the mother did not subsequently prove to be syphilitic, are too rare to alter our view on this point.

Furthermore, we have reasons to assume that the infection of the fetus usually does not occur prior to the fourth or fifth month of pregnancy. This view is supported by Thomsen's investigations, which later have been confirmed by Trinchese and Baisch. However, the fetus can be infected at a much later stage of pregnancy, even during parturition. Still, there is no conclusive evidence that Rietchel is right, when he claims that the later infection of the fetus particularly occurs in the last month of pregnancy or during parturition, and our material does not support this view.

The probability of transmission of syphilis from mother to child is illustrated in Table I, which comprises 545 cases.

Every patient was carefully examined, and all the children were observed for half a year or more, often for several years.

Looking at the first series, which comprises 201 women who never were treated, we find that 194 of their children showed signs of syphilis at birth or shortly afterwards. Only seven children remained healthy.

The second series includes 87 patients who previously were treated with mercury but had received no treatment during pregnancy. Here, too, the result was very poor: only nine children proved to be free of syphilis.

TABLE I

TREATMENT OF THE MOTHER'S LESION	NUMBER OF CASES	SYPHILITIC CHILDREN	NONSYPHILITIC CHILDREN
No treatment - - - - -	201	194	7
Mercury before pregnancy, no treatment during pregnancy - - - - -	87	78	9
Salvarsan before pregnancy, no treat- ment during pregnancy - - - - -	15	12	3
Mercury during pregnancy - - - - -	111	80	31
Salvarsan during pregnancy - - - - -	98	19	79
Salvarsan before pregnancy, mercury during pregnancy - - - - -	26	7	19
Salvarsan before pregnancy, salvarsan during pregnancy - - - - -	7	1	6
	545		

The third series demonstrates that the earlier confidence in the efficacy of salvarsan as a cure was not altogether justified. Fifteen patients who were treated with salvarsan previous to pregnancy, bore but three healthy children.

Nor does mercury treatment by itself in pregnancy produce very satisfactory results. One hundred eleven mothers who were treated with mercury during pregnancy, bore only 31 healthy children.

The great superiority of salvarsan in this respect is evident from the next series. Here we have 98 cases treated with salvarsan during pregnancy, and 79 of these gave birth to healthy children.

The two last series likewise demonstrate the great value of the salvarsan treatment. Twenty-six patients were given salvarsan previous to pregnancy and mercury during pregnancy; they gave birth to 19 healthy children. Seven patients who were given salvarsan during as well as before pregnancy bore six healthy children.

The fact that all the children in this group have been under observation for a considerable time, some of them for years, makes this table the more significant.

These results are in conformity with the earlier reports by Belding, Hunter, Williams, Peterson, Adams, Fraser, and Impey, Kendell, King, Lawrence, and Beck, to mention a few authors on this subject.

A nontreated syphilitic mother will practically always give birth to a syphilitic child. The question is: At what period of pregnancy should treatment be given? And what sort of treatment?

Far the best results are obtained with salvarsan—as it also appears from this table—and this preparation should be used as a rule, but the urine must be watched very closely, particularly in the last part of pregnancy, when the occurrence of albuminuria constitutes a contraindication against its use. The report by Kristjansen is of interest in this connection; for it shows that of all the patients who were treated with salvarsan at Rudolf Bergh's Venerological Hospital dur-

ing the last ten years, four died from salvarsan poisoning, and three of these were pregnant women.

According to our own experience salvarsan does, on the other hand, not particularly often cause abortion.

Our present scheme of treatment is in all essentials as follows:

In the case of a patient with a recent infection who is admitted in the first months of pregnancy, we begin with an initial mercury treatment, either in form of injections or as inunctions, e.g., seven inunctions of 3 grams. Then salvarsan is given together with continued mercury treatment; four injections of salvarsan are given at intervals of a week, either "Old Salvarsan" in doses increasing from 30 to 40 gm. or "neosalvarsan" increasing from 0.15 to 0.30 gm. This treatment takes about six to seven weeks. We then discontinue all treatment for a month, and then give the patient 30 inunctions or six injections of salicylate of mercury. In the middle of pregnancy we give this patient another energetic combined treatment with mercury and salvarsan, eight to ten salvarsan injections all told. Then treatment is discontinued for a similar period, and followed by mercury. The treatment now is discontinued, if parturition is near at hand; but, if feasible, mercury treatment is given once more a month later.

If the patient previously has been treated thoroughly, we lay particular stress on the combined mercury-salvarsan treatment in the middle of pregnancy because, according to Thomsen's investigations, the spirochetes are particularly liable to invade the fetus at this time.

This scheme of treatment can, of course, be modified in various ways. It is relatively sure and safe. Boas has treated 42 private patients in this fashion during the last six and one-half years, and all gave birth to healthy children. The youngest of these children is now nine months old, and none of them has ever shown the slightest sign of syphilis.

It should be emphasized that the age of the lesion must not influence the thoroughness of the treatment. We have not been able to confirm the postulate of Kassowitz, that the virus gradually becomes attenuated. Our point of view is shared by Buseke, Rasch, and Nobel, and is sustained by numerous cases in our material. The following case is a striking illustration of this fact:

The patient was infected with syphilis in 1891 and was treated during 1891 to '92, with 50 inunctions of 5 gm. of ung. hydrargyri. She has had no later manifestations of the lesion, and received no further treatment. She was pregnant 12 times, with the following results:

1. 1895. Stillborn.
2. 1897. Healthy child (Wassermann reaction negative at the age of 15 years).
3. 1900. Child died from congenital syphilis.
4. 1902. Stillborn.
5. 1903. Abortion.
6. 1904. Healthy child (Wassermann reaction negative at the age of 8 years).

7. 1905. Healthy child (Wassermann reaction, negative at the age of 7 years).
8. 1906. Child died from congenital syphilis.
9. 1907. Abortion.
10. 1908. Healthy child (Wassermann reaction negative at the age of 4 years).
11. 1909. Child died from congenital syphilis.
12. 1912. Child with extensive eruptions, died from congenital syphilis.

It is difficult to conceive of anything more planless; it is particularly striking that two healthy children were born in 1904 and 1905, while another child with definite congenital syphilis was born in 1912.

In order to elucidate this problem from another angle, we have arranged our material as in Table II.

TABLE II

NUMBER OF YEARS SINCE INFECTION OF THE MOTHER	SYPHILITIC CHILDREN	HEALTHY CHILDREN
4	11	0
5	8	1
6	5	2
7	2	0
8	6	0
9	1	0
10	4	0
11	3	1
12	1	1
13	1	1
14	1	0
15	1	1
16	1	0
17	1	0
18	0	0
19	1	0
20	1	0
Total	48	7

All of these mothers were treated more or less intensively with salvarsan and mercury in the first years after infection, but were not treated later on. We find that four syphilitic children were born ten years after the infection of the mother, and syphilitic children were born even as late as twenty years after the initial infection. The total numbers in the columns are striking: 48 syphilitic children and only seven healthy ones. These findings emphatically discount the idea that the virus generally becomes attenuated with the passage of time.

We likewise treat the mother when she becomes infected during the last part of pregnancy. And we do not omit to treat the mothers who previously were treated intensively. The necessity of this precaution is evident from the following case in our series:

A woman who, immediately after the initial infection had been treated intensively with mercury and salvarsan, received intermittent mercury treatment during the following three years. She became pregnant four years after the infection and, in view of the past intensive treatment, she was not treated during pregnancy. She gave birth to a macerated fetus with typical syphilitic lesions.



We do not rely on a negative Wassermann reaction, for this may fail. Our material comprises several instances of this kind. I shall merely mention the following typical example:

The patient was previously treated with salvarsan and mercury. She then was under observation for one year, during which she showed no clinical or serologic sign of syphilis. She became pregnant, but was not treated because she was examined each month, serologically as well as clinically, and always found free of any sign of syphilis. She had a relapse of the lesion two weeks before parturition; the Wassermann reaction became positive, and she gave birth to a child with recent syphilitic eruptions.

We thus conclude: Every syphilitic woman should be treated during pregnancy with salvarsan and mercury or bismuth, without any regard to the date of the initial infection, with no regard to a previous intensive treatment, and, finally, without any regard to a negative Wassermann reaction. Consequently, the principal method of combating the congenital syphilis is to treat the syphilitic mother during pregnancy.

In order to do this effectively, it is of the greatest importance that the diagnosis be made as early as possible. This can be done only when the physicians pay attention to this point in their examinations of pregnant women and, in doubtful cases, have the blood of the patients tested serologically.

That a serum test should be done on all women admitted to the large lying-in hospitals, is generally recognized and requires no further motivation. But are the serum reactions during pregnancy dependable? Or do nonspecific reactions occur in pregnancy? Boas and I have investigated the question with regard to the Wassermann reaction, which is the routine test in Denmark.

We have done this test on 2200 pregnant women, of which 148, i.e., 6.7 per cent, gave a positive reaction. Eighty-four of these 148 women gave a past history of syphilis and showed definite clinical signs of this lesion and 15 patients could not be traced again. Forty-four women gave a positive reaction one-half to two years after parturition; and six of these admitted now that they had had syphilis, while one stated that the father of the child had had syphilis. This leaves 37 who gave a positive reaction a long time after parturition and I feel justified in regarding these women as syphilitics, partly on account of the later positive reactions, partly because some of their children later developed signs of syphilis. At any rate, none of these positive reactions could be due to the pregnancy. Five patients remain, whose reactions were as follows:

	1	2	3	(4)	(5)
At parturition	+	+	+	+	0
7 days after parturition	+	+	+	+	+
1½ year later	+	+	+	+	+

However, No. 4 admitted later on that her husband had been treated for syphilis seven years previously. In the case of No. 5, on whom only one test was done at the time of confinement, the test was done seven days after chloroform anesthesia, which according to Boas and others, can produce a positive Wassermann reaction.

This leaves only three or, if we include No. 5, four cases, in which the Wassermann reaction can be said to have failed. These four instances in 2200 patients make 0.17 per cent. This number is really so small that one is justified in concluding there is no indication of the Wassermann reaction becoming nonspecific during pregnancy. The four instances may, perhaps, have been due to technical errors, or it might be that the reaction is accentuated by pregnancy, as stated by Pankow.

We then have all reason for the assertion that a positive Wassermann reaction in pregnancy is just as dependable as at any other time.

In this series of tests we also have employed the Kahn and Sigma reactions; these tests gave largely the same results as those obtained with the Wassermann reaction. The condition for a dependable result is that one uses blood from a vein. Several authors have recommended the use of retroplacental blood; but we have made a number of tests, which show that the retroplacental blood all too frequently gives nonspecific reactions.

While the Wassermann reaction and the serum reactions on the whole are of the greatest importance, in an attempt to discover a latent syphilis in the mother, they are much less significant in dealing with the newborn child. Of course, we consider the child to be definitely syphilitic when it shows manifestations of syphilis, but also when the mother has eruptions and, as well as the child, gives a strongly positive Wassermann reaction. We likewise consider the child syphilitic, when it as well as its mother gives a strongly positive Wassermann reaction, even in the absence of eruptions.

If, on the other hand, the Wassermann reaction of the child is weak, I do not think that one is justified in stating more than the probability of the child having syphilis. For according to our experiences, and Williams is of the same opinion, the weak reaction may be due to reacting substances which have passed from the mother to the child. Nor can we say for certain that a child has syphilis because its mother gives a positive Wassermann reaction, if the child gives a negative Wassermann reaction, and does not show any clinical sign of syphilis.

The other criteria, which ordinarily may be of value to the diagnosis, such as examination of the umbilical cord, placenta, and x-ray

plates of the epiphyses, have not been of much use to us. Really, they have given positive results only in those cases where the diagnosis already was assured.

Hence it follows that in numerous cases it is practically impossible to decide at birth whether the child has syphilis. As to the proper standpoint in the case of these children, two views prevail. One is to the effect that every child of syphilitic parents should receive anti-syphilitic treatment, even though it does not present clinical or serologic signs. Carle, Welander, and Beck are the foremost advocates of this view.

Ehlers and Hoffmann hold an intermediate position; they will only treat children born of mothers with syphilis of recent date, i.e., children who most likely have syphilis, although they show no signs of this lesion.

Personally I hold the same view as Ahmann and Almkvist; namely, that these suspected children should not be treated before they show clinical signs of syphilis or give a positive Wassermann reaction. They should be watched, not treated.

One reason for our view is the testimony in Table I. Here we have 98 cases of syphilis treated with salvarsan during pregnancy, and only in 19 instances did the children later show signs of syphilis; 79 children were healthy at birth and stayed healthy. If we had treated all these children according to Welander, i.e., if we had treated them prophylactically, we would never have been able to recognize the fact that these children did not have syphilis at all; throughout their whole lives they would have been branded syphilitics and been regarded as such. And we have no right to do that.

I fully endorse Almkvist when he says: "It has always been considered an altogether unscientific procedure in case of acquired syphilis to start the treatment before definite symptoms have established the diagnosis; and I cannot see that this procedure is less unscientific just because it involves little children instead of grown persons."

We have, therefore, dissociated ourselves from the prophylactic treatment and place these children under clinical and serologic observation.

As to lactation, I consider it very important that these children get mother's milk, for the simple reason that the mortality of suckling babies is much lower than the death rate of bottle-fed babies. I do not believe there is any great danger of infection by way of the breast milk, and the possible danger is more than counterbalanced by the advantages of getting breast feeding. The only condition in which I forbid the breast milk, is the case where the mother is infected late in pregnancy, and where the child apparently is healthy. Sometimes we have taken the precaution to pump the breast and keep the milk for hours at the freezing point.

And, finally, I want to discuss the third question: "The problems of state and society in combating congenital syphilis."

The Danish law contains the following paragraphs:

Everybody who knows or surmises himself or herself to suffer from venereal disease and, notwithstanding, indulges in sexual intercourse, is liable to prosecution; this applies to married as well as nonmarried persons.

Any person who knows himself to suffer from venereal disease must submit to treatment for it. Failure to do so is punishable.

Everyone, rich or poor, is entitled to free treatment for venereal disease; this treatment is given in the hospitals and in the clinics throughout the country in addition hereto. Copenhagen has 12 minor clinics under supervision of recognized specialists, where ambulant treatment is given.

These smaller clinics form a great asset, as they are established in private residences and thus assure discreet treatment.

If a patient refuses to submit to treatment or fails to appear for further treatment, the physician in charge must see to it that the police department requests this person to receive the necessary treatment. If necessary the patient can be interned in a hospital for treatment; but this is seldom necessary.

These forcible measures are likewise applied to persons whose conduct is such as to involve the danger of infecting others. And it is the duty of the physician to make the patients acquainted with the provisions of the law.

And, of course, the law forbids a syphilitic baby to be suckled by anybody but its own mother. If a nurse knows or suspects herself to have syphilis, and still acts as wet nurse to another's child, she is liable to punishment.

Thus the law rules that all venereal patients must have themselves treated by a licensed physician, and not by a quack. The requirement of a health certificate in marriage is likewise a precaution against the introduction of syphilis in married life. For the sake of completeness, I may add that Denmark has no authorized prostitution.

These rules are aimed at syphilis in general. I shall briefly outline the development of our fight against congenital syphilis.

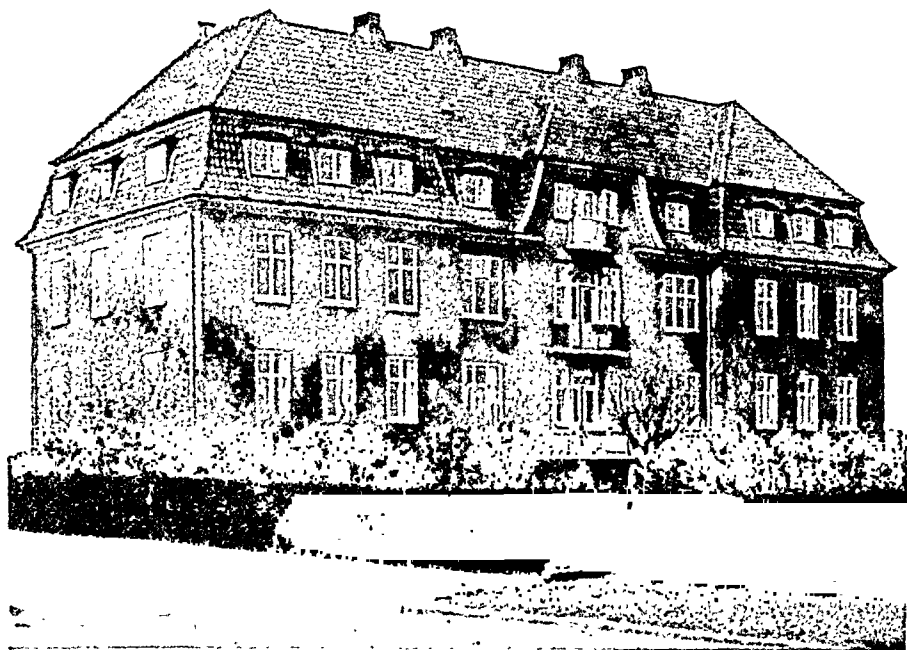
The venereal clinics consistently and continuously point out to the women patients, how important it is that they return for treatment in case of pregnancy; and the treatment during pregnancy is the most intensive possible.

In the prenatal clinic, which is associated with the lying-in department of the hospital, we always watch very closely for syphilis, and we try to discover the cases of latent syphilis by means of the Wassermann reaction.

In the case of a syphilitic child we try to keep the child and mother together and treat both at the same time.

But this cannot always be done, and then the question arises: Where can we place these children?

The Stockholm physician Welander was the first to tackle this question when he founded a special asylum for these children. And thanks to Professor Ehlers such an asylum was established in Copenhagen in 1916. At first this home could accommodate 52 patients; but it has progressed and extended. Denmark has at this time 150 beds for syphilitic children exclusively. The homes were built and



The Welander Home for syphilitic children, Copenhagen, Denmark.

equipped by private donations; state and municipal governments contribute to their maintenance and working expenses.

The types and the ages of the patients have changed in the course of time. In the first years, most of the patients were older children with syphilis of relatively long standing. But the extensive use of the Wassermann reaction and intimate collaboration with the large lying-in departments have resulted in syphilitic children being transferred to these homes almost immediately after birth. They usually stay here four to five years, and then are given to their foster-parents although they still are under continuous observation.

The effect of these "Welander homes" in reducing the death rate among these children has been so great that this alone is sufficient reason for recommending their establishment. Add to this the enor-

mous social benefit derived because the syphilitic children no longer are placed in ordinary foster homes where they might infect other children.

But, as stated before, there are some children who cannot be said for sure to be syphilitics. For this reason, according to my advice, the Welander homes have extended their services, and they have established a special observation department for these children, who are transferred to this department immediately after birth where they are under clinical and serologic observation for about six months. If they show no signs of syphilis during that time, they are discharged; otherwise they are transferred to the home proper.

But even though the Welander homes accomplish a great work and are capable of saving a large number of children who otherwise would perish, and even though they isolate these children and thus prevent the spreading of the infection, these tasks should not be the leading features of the fight against congenital syphilis. The chief purpose should be an intensive prophylactic treatment of the mother during pregnancy; it is never indifferent to the child, whether it is healthy from birth or merely recovers by long-continued treatment.

Denmark has attained that stage in its fight against congenital syphilis where this disease soon will become a rare occurrence, and this fact is chiefly due to the small size of the country. It is much easier to watch the individuals in a small country than it is in a large country, but even so, the large countries certainly ought to try to solve this problem along the same lines. Every effort should be made to educate the public on this subject and to tear asunder that veil of mystery which yet envelops the venereal diseases in many places.

The Danish Society for Eradication of Venereal Diseases has done a great pioneering work; the appreciation it has met with in all classes is, perhaps, best illustrated by the fact that the Queen of the country is the patroness of the Welander homes. The fight against tuberculosis, the fight against cancer, and the fight against venereal diseases are three problems which can be solved only through the co-operation of the physicians, the public, and the state.

*(For discussion, see page 873.)*

## PUERPERAL HEMIPLEGIA

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SINCE 1904, when Rudolph von Hösslin, a German neurologist, published a monumental study of the various puerperal paralyses, in which he reviewed, among other types, 146 cases of cerebral palsy, scant attention has been paid puerperal hemiplegia either in obstetric or in neurologic literature. When mentioned in textbooks it is usually dismissed briefly as one of the rare complications of eclampsia. While the condition is avowedly uncommon, the number of cases that Hösslin was able to collect, as well as the evidence afforded by the seven cases in this report, indicate that it occurs with sufficient frequency to merit careful consideration, particularly in the matters of etiology and prognosis.

Puerperal hemiplegia is sufficiently rare to render statistics of its incidence scanty, and when available, conflicting. Thus, Villa observed only two examples of the condition in twenty-seven years among 10,000 deliveries, while Immelmann in the Frauenklinik of Berlin saw eight cases within two years. Hösslin's collection of 146 cases in 1904 suggests that the condition is not uncommon, but this figure probably approximates very closely all the recorded cases prior to that date; it moreover includes a group of cases, which, while central in origin, were not hemiplegic, namely, cases 1 to 27 (hysteria), and 28 to 34 (myasthenia gravis). Talley and Ashton in 1925 were able to collect only seventeen cases recorded since 1896 but excluded from their list all cases associated with eclampsia or cerebral hemorrhage. The evidence at hand would seem to indicate that puerperal hemiplegia is considerably more common than are peripheral maternal palsies due to birth trauma. In Charpentiere's study embracing 114 cases of various puerperal paralyses, he listed fifty-seven as hemiplegic and only twelve as traumatic (mostly due to forceps pressure on nerve roots). Hösslin included eighty-one cases due to trauma (forceps, breech extraction and prolonged labor) as against 112 due to spontaneous vascular accidents in the brain. Our records show similar percentages; during the four year period in which we observed seven cases of central puerperal palsy, we saw only one of local, traumatic origin, a difficult forceps case that was delivered elsewhere.

The immediate causes of puerperal hemiplegia are of course those of apoplexy in general, namely, (1) intracranial hemorrhage from rupture of a blood vessel (hemorrhagic apoplexy), and (2) acute

cerebral softening from embolism or thrombosis (embolic or thrombotic apoplexy). It has long been known that neither of these causal agents is primary, the former being secondary usually to arterial changes, nephritis or syphilis and the latter to infection, circulatory stasis or anemia. It will be noted in the course of this paper that, with the exception of syphilis, any one or all of these contributory elements may be furnished by the common complications of pregnancy and labor (infection, toxemia, hemorrhage).

#### PUERPERAL HEMIPLEGIA FROM CEREBRAL HEMORRHAGE

Brain hemorrhage, incident to the toxemias of late pregnancy, has long been recognized as a common cause of puerperal hemiplegia and is probably responsible for most cases occurring in close conjunction with labor. This relationship is substantiated not only by numerous autopsy observations on fatal cases of hemiplegia but also by the high incidence of cerebral changes in patients dying of eclampsia. Thus Prutz noted edema in 42 per cent, hyperemia in 35 per cent, and apoplexy in 13 per cent, while the brain was apparently normal in only 10 per cent of his cases. Quite recently Gammeltoft made a careful study of the brains of twenty-four fatal cases of eclampsia and found in nine, hemorrhages of sufficient size to be of significance in the lethal issue; in four others there was edema with small superficial hemorrhages. While the rôle of brain hemorrhage in these cases seems clear, the exact mechanism by which the toxemias produce this phenomenon is not so obvious. Since normal blood vessels do not rupture without external trauma, the simple factors of elevated blood pressure and the bearing-down efforts incident to labor are not sufficient to account for it, and in order to arrive at a plausible explanation, it is necessary to postulate a third factor, namely, structural damage to the vessel walls. That such changes do occur is in accord with Zangemeister's theory of eclampsia and as well with the recent findings of several Continental investigators. For instance, Jaffe reports that in cases of death from eclampsia the cerebral vessels show extensive changes, varying from slight swelling and poor staining nuclei to an actual hyalinization of the vessel wall with disappearance of the nuclei. It is his opinion that the media is first involved, later the intima, and he is in agreement with Hinselmann in concluding that the injury to the vessel walls is due to spasm of the arterioles which results finally in necrosis of the smaller branches. In the opinion of Domagk, endothelial changes play a major rôle in eclampsia and are responsible, directly or indirectly, for a great part of the clinical picture; pulmonary edema, so frequently met in eclampsia, is particularly mentioned as being due to previous capillary injury; the well-known liver changes are interpreted in the same light. If these views may be accepted, they explain on a very definite basis the occasional



occurrence of cerebral hemorrhage in the toxemias of pregnancy. Conversely, it may be noted, cases of puerperal hemiplegia from brain hemorrhage apparently constitute a very convincing substantiation of the important rôle that vessel damage may play in eclampsia and the other toxemias of late pregnancy.

Puerperal hemiplegia from cerebral hemorrhage is characterized clinically by its tendency to occur during or shortly after labor, by its suddenness of onset and by the coexistence of a toxemia of pregnancy. The paralysis usually attains its full extent within a few hours. The condition appears to be more common in the latter years of the child-bearing period. Among the cases of hemiplegia due to brain hemorrhage that were reviewed by Hösslin, the majority were over thirty years of age and seven were forty or over. Of our two cases of this type, one was twenty-nine, the other forty-four.

CASE 1.—A married Chinese primigravida, age twenty-eight, at term and in labor, was admitted on the morning of July 4, 1923. She had not had prenatal supervision, but gave no history of toxic symptoms and showed no edema. B.P. 145/90. Labor appeared to progress normally until at 10 P.M., when the cervix was almost fully dilated, she suffered a typical eclamptic convulsion followed by coma. As she regained semiconsciousness, it was discovered that the right arm and leg were paralyzed. Catheterized urine showed albumin plus 4, and hyaline and granular casts; B.P. 150/90. Labor was terminated with low forceps; child living and well. There were no further convulsions.

The patient remained in semicoma for 5 days. There was no active motion of the right arm or leg; tendon reflexes on right were absent. The eyes were deviated to the left. There was dull response to pin prick on right side of body, prompt response to stimulation on left. Lumbar puncture: 5 c.c. of spinal fluid under increased pressure were withdrawn, pink in color with well mixed red blood cells. Retinal examination revealed papilloedema, bilateral. Blood chemical studies showed definite nitrogen retention: N.P.N. 46 (mg. per 100 c.c.), urea N. 30, uric acid 9, creatinine 1.5,  $\text{CO}_2$  combining power 53 per cent. Blood and spinal Wassermanns negative. Blood pressure remained the same; the urinary albumen decreased. Temp. elevated (39.5 on July 6 and 7). Pulse 100-120.

On July 9, the fifth day postpartum, consciousness gradually returned, but with it the evidence of complete aphasia. The mouth muscles, however, could be moved sufficiently to suck fluids through a tube. The paresis of the ocular muscles had disappeared.

During the ensuing weeks the following changes transpired: the aphasia began to improve 20 days after delivery and on discharge (46 days postpartum) the patient could speak intelligibly but not distinctly. All facial paralysis had disappeared. Voluntary movements of the right leg started 25 days after delivery and when the patient was discharged the leg could be used for walking, but there was a decided limp. The right arm remained paretic. The urinary albumen disappeared until only a "trace" was present on dismissal; the blood pressure gradually fell to 135/85; the nitrogen retention decreased only slightly (N.P.N. 42). The retina returned to normal.

The patient has been watched carefully during the past 4 years and the following significant events have occurred: October, 1923 (4 months p.p.) attack of Jacksonian epilepsy, involving mostly right side and sufficiently severe to throw patient to floor dislocating left shoulder. Similar attacks in December, 1923, January, 1924

and October, 1924. Various manifestations of slight mental deterioration appeared: irritability, forgetfulness, etc.; these persisted for about a year and then subsided. The blood pressure returned entirely to normal and the urinary albumen completely disappeared. In 1927 the patient again became pregnant and supravaginal hysterectomy was done at the 3rd month for purposes of therapeutic abortion and permanent sterilization.

Four and one-half years after delivery the right arm remains sufficiently paralyzed to be of no practical use, in spite of prolonged physiotherapy. There is still a slight loss of function of the right leg. Mentality normal; speech shows detectable "slur." No convulsive seizures during past two years.

*Final Diagnosis:* Hemorrhage of middle cerebral artery into internal capsule incident to toxemia of pregnancy.

CASE 2.—A married Chinese woman, age forty-four, para ix, seven months' pregnant, was admitted on the morning of September 13, 1926 in deep coma. She was said to have had increasing edema of feet, hands and face for twenty days; during the previous four days, she had suffered blurring of vision, headaches and on the evening before, distinct lethargy. At 6 A.M. on the morning of admission there was said to have been a convulsion of the upper extremities followed by unconsciousness. No history of previous nephritis.

Examination on admission: Patient comatose with labored, stertorous respiration; marked edema of ankles, hands and face. B.P. 180/110. Catheterized urine: Albumen plus 4, many granular casts. Blood chemical findings: N.P.N. 35 (mg. per 100 c.c.), uric acid 5.7, creatinine 1.5, CO<sub>2</sub> combining power 54 per cent. Blood Wassermann negative. Retinal examination revealed marked bilateral papilloedema with multiple hemorrhages.

There were no convulsions after admission, but the coma continued. Patient was treated with glucose intravenously and insulin. During the day she went into labor and delivered at 10 P.M. a stillborn 1254 gram fetus. (Fetal heart had not been heard.)

The patient remained in semicoma. At 9 P.M. on September 14th, twenty-three hours after delivery, the patient suddenly showed marked rigidity of the upper extremities and jaws associated with deepening of the coma, rapid pulse and involuntary passing of urine and stools. The following morning when consciousness had improved, it was discovered that the left upper limb showed flaccid paralysis; the left lower limb was moved voluntarily but was weak. Tendon reflexes present and about equal on both sides; abortive ankle clonus on left. Sensation present on both sides. Spinal puncture: fluid clear and transparent; pressure 190 mm.; cell count 1 or 2. B.P. had risen to 220/120.

During the ensuing two weeks the patient's neurologic symptoms improved markedly and on discharge, 19 days after delivery, she had full use of her left leg and could move the left arm voluntarily; the latter, however, was distinctly weak. Renal function tests showed definite kidney damage and on discharge the urinary albumen was still 1 gram per liter and the B.P. 150/100.

One year after delivery the left hand is still weak. B.P. 205/120. Urinary albumen plus 2; a few hyaline casts.

*Final Diagnosis:* Cerebral hemorrhage incident to nephritic toxemia of pregnancy.

Both the immediate and ultimate prognosis of puerperal hemiplegia following brain hemorrhage is grave. Of the forty cases summarized by Hösslin, twenty-nine died, the majority within a few days. Patients who survive the hemiplegia may later succumb to an underlying

nephritis. A very definite relationship seems to exist between the severity of an attack and its proximity to labor, cases of cerebral hemorrhage that occur a few days after delivery tending to be more benign than the intrapartum variety. Of sixteen cases cited by Hösslin in which the brain hemorrhage took place during or immediately after parturition, all the patients died; while of twenty cases in which the seizure occurred several days postpartum, over half survived. This generalization applies not only to the immediate prognosis for life, but also to the ultimate prognosis of the paralysis. The latter point is borne out by the histories of Cases 1 and 2; the puerpera in Case 2, in which the seizure occurred twenty-three hours postpartum, recovered more quickly and more completely than the patient in Case 1, although the former was older and had more definite signs of a permanent nephritis. Deep and prolonged coma, absence of reflexes, marked elevation of temperature and other evidences of an extensive hemorrhage, point of course to a lethal issue; in the event the patient survives, such signs, particularly if aphasia also occurs, forecast inevitably a certain degree of permanent paralysis. The ultimate disability, however, is never so great as the initial palsy. Rapid improvement may be expected for about three months and then a less marked progress for a year; as in other forms of apoplexy the aphasia, the face, leg and arm paralyses clear up in the order named. Few cases escape a certain degree of finger or hand disability. Attacks of Jacksonian epilepsy and varying degrees of mental impairment, as evidenced in Case 1, may be expected in patients who have suffered extensive hemorrhages with resultant softening of larger or smaller areas of brain tissue.

Concerning the prognosis for future pregnancies after this type of puerperal hemiplegia, scant data are available. Immelmann has reported a case in which hemiplegia, incident to eclampsia (?), occurred in two successive pregnancies, the second seizure being fatal; autopsy showed massive hemorrhage into both ventricles. It will be noted that both our cases gave clear evidence of renal damage, the first by persistent, prolonged nitrogen retention and the latter by elevated blood pressure and urinary albumin a year after delivery. While we have no statistics to support such a view, we feel that the majority of cases of puerperal cerebral hemorrhage are likewise consequent to a toxemia that is essentially nephritic and that, on this ground alone, therapeutic abortion with permanent sterilization is probably justifiable.

#### PUERPERAL HEMIPLEGIA FROM CEREBRAL THROMBOPHLEBITIS

While the earlier writers considered brain hemorrhage, incident to eclampsia and nephritis, as the most common cause of puerperal hemiplegia, our present knowledge points rather to cerebral thrombo-

phlebitis as the most frequent etiologic agent. Talley and Ashton, in their recent study of the centric puerperal palsies, corroborate this view and recall that in puerperal infection, however mild, all the elements necessary to thrombus formation are present—bacteria to injure the intima, and sluggish circulation to favor the deposition of blood platelets on the necrotic wall, a change which initiates the processes leading to clotting. Two other factors, biochemical in nature, augment this tendency, namely, the marked increase during the puerperium of plasma fibrin and the correlated acceleration in the sedimentation rate of the red blood corpuscles. Fibrin increases gradually during pregnancy until in the first week of the puerperium, it reaches 0.45 per cent, whereas readings in normal nonpregnant women average 0.31 per cent (Plass). In puerperal sepsis the figures are still higher and in a series of plasma fibrin determinations we have been making on such cases in this clinic, values of 0.7 and 0.8 per cent are not uncommon. Closely paralleling the plasma fibrin changes, the sedimentation rate of the red cells increases rapidly during gestation until on the third or fourth day of the puerperium it varies between thirty and forty minutes (Linzenmeier method); in infected puerpera, as shown in a previous communication by the writer, the rate is still further accelerated, occasionally reaching ten minutes. The importance of these two changes, as contributory factors to thrombus formation, seems obvious.

Puerperal cerebral thrombophlebitis is probably always mycotic in origin, secondary to infectious thrombophlebitis in the uterine, iliac, or femoral veins. It is important, however, particularly from the obstetrician's viewpoint, to recall that the pelvic infection may be either frank or concealed. Of singular interest in this connection is the minutely studied case of Hunt's: A primipara, twenty-one years old, on the twentieth day after an apparently normal delivery and puerperium, was seized with severe headaches, vomiting and general convulsions. The convulsive seizures continued and were both general and Jacksonian in type. Paralysis of the right side of the face, right arm and motor aphasia supervened. The patient gradually sank into a stupor and succumbed on the tenth day of the disease. Autopsy showed extensive thrombosis of the dural sinuses, the superior longitudinal, lateral and petrosal sinuses; also thrombosis of the cerebral veins with extensive softening of the cerebral cortex. *The uterus was small, firm and clean. The appendages were normal.* Almost identical cases have been reported by Zangemeister and Collier. In certain other instances the hemiplegia may occur before the pelvic phlebitis can be demonstrated, as in a case of Talley's in which the apoplectic seizure preceded by three days the detectable pelvic phlebitis.

Postpartum cerebral thrombosis is characterized clinically by, (1) tardiness of onset, the seizure occurring usually five to twenty days

postpartum, sometimes later; (2) the presence of prodromata—headache, numbness in the fingers, hands, or face, and difficulty in speech; (3) slowness of onset, the hemiplegia developing gradually, taking several hours or days, and often coming on with remissions; and (4) the persistence of a slight, unexplained elevation of temperature after delivery with a gradual, progressive, prolonged increase in pulse rate. But to decide in a given case that puerperal hemiplegia is due to cerebral thrombophlebitis, embolism, or hemorrhage, is difficult if not sometimes impossible, and when the case does not come to autopsy, the diagnosis must usually be held as largely presumptive.

CASE 3.—A married Chinese woman, age 29, para v, eight months' pregnant, was admitted on October 5, 1926, on account of increasing edema of the extremities and face of a month's duration, associated with headache, vertigo and occasional blurring of vision. B.P. 155/125. Urinary albumin 0.1 per cent; no casts. Urinary output low, about 400 c.c. daily. Blood chemistry normal. Fundi normal. Wassermann negative. Despite usual therapeutic measures, the edema and albumen increased, the CO<sub>2</sub> combining power dropping from 50 to 38 per cent. On October 12 she went into labor and delivered spontaneously a 2775 grams still-born fetus.

The patient appeared to improve decidedly for six days after delivery, the blood pressure returning to normal, the urinary output increasing and the albumen disappearing. The pulse remained persistently rapid, however, varying between 110 and 120; there was no elevation of temperature. On the morning of the seventh day she complained of headache over the right half of the head and numbness of the left arm. At noon she had obvious difficulty in speaking. At 4 P.M. she complained of numbness of the right arm. Examination showed slight weakness of lower left face and both limbs; faint perception of left face and upper left limb was much reduced. At 3:30 A.M. on the eighth day she was heard to emit a high-pitched scream following which she went into a general convulsion which terminated in coma, the latter lasting ten minutes. Upon return to consciousness there was marked weakness of both handgrips, particularly the right; no aphasia. At 7 A.M. another convulsion, general and clonic in type; at 9 A.M. a third convulsion, followed by deep coma. Upon regaining consciousness there was complete paralysis of the right arm and distinct weakness of the right leg. She remained stuporous for 24 hours. Temp. 39, pulse 136.

For the remainder of the patient's stay in the hospital, there persisted occasional attacks of Jacksonian epilepsy involving the right upper limb and face and lasting ten to twenty minutes. On discharge, fifty-one days after delivery, there remained a slight loss of power in the right leg and a moderate loss of function of the right hand.

The report one year after delivery is of multiple attacks of Jacksonian epilepsy, six during the previous two months. Still complains of numbness and weakness of the right hand. Thenar and hypothenar eminences of the right hand demonstrably atrophied. Personality "hysterical."

*Final Diagnosis:* Cerebral thrombophlebitis, probably secondary to an unrecognized puerperal infection.

The toxemia of pregnancy was such an outstanding feature of Case 3, particularly prior to delivery, that the question arises as to its possible relationship to the later cerebral thrombosis. While the obscure state of our knowledge concerning the toxemias of pregnancy

precludes definite answer of this inquiry, the following considerations seem pertinent. In several cases recorded by others a toxemia of pregnancy has preceded the development of cerebral thrombophlebitis. For instance, Zangemeister has recently reported the case of a twenty-five-year-old secundigravida in whom forceps delivery had been done for threatened eclampsia; on the thirteenth day postpartum, when elevated blood pressure, albuminuria and other signs of toxemia had disappeared, stupor and left-sided convulsions set in. Death ensued within a few hours. At autopsy there was complete thrombosis of the longitudinal and transverse sinuses. Zangemeister feels that the toxemias of pregnancy produce certain changes in the intima of the blood vessels which predispose to thrombosis. Enough has already been said concerning the likelihood of vessel damage in such conditions to make it conceivable that the injured areas might, in the presence of bacteremia, serve as foci for thrombus formation.

The prognosis of puerperal cerebral thrombosis is not only grave but extremely uncertain. In the case of brain hemorrhage the paralysis is usually complete soon after the onset so that a rough estimate of the extent of the final tissue damage may be attempted soon after the first seizure, but in thrombosis, where one is dealing with a gradually progressive process, it is difficult, if not impossible, to ascertain to what limits it will extend. The severity of the attack seems to bear no relationship either to the time of onset or to the degree of the primary infection. In the above case, for instance, the pelvic infection appeared negligible, whereas in Hunt's fatal case even autopsy study failed to reveal changes in the uterus or pelvis. The prognosis of the chronic stage of puerperal cerebral thrombophlebitis, is much the same as that of hemorrhage and depends altogether on the amount and location of the brain tissue damage, as evidenced by neurologic symptoms and signs.

#### PUERPERAL HEMIPLEGIA FROM CEREBRAL EMBOLISM

That endocarditis, acute or recurrent, may lead to puerperal palsy from brain embolism is obvious, but this occurrence probably represents a coincidental event rather than a complication intrinsically related to the puerperal state. Other interpretations of the phenomenon seem hardly in keeping, at any rate, with the well-known frequency of chronic endocarditis in pregnancy on the one hand and with the rarity of puerperal cerebral embolism on the other. Recently, Corwin, Herrick, Valentine and Wilson tabulated the results of a careful personal study of 172 cases of chronic cardiac valvular disease complicating pregnancy and reached the conclusion that "liability to embolism, so frequent in younger women with mitral stenosis, seems not to be increased by pregnancy and labor."

Interest in puerperal cerebral embolism, however, has centered not

so much about the type of case just mentioned, as around a group of cases in which emboli have apparently reached the brain from thrombotic foci in the pelvis, the result of puerperal sepsis. The cause of the interest has lain largely in the problem of how such detached fragments of pelvic or femoral thrombi can pass the pulmonary capillaries, a question that has still not received adequate answer, but upon which several plausible suppositions have been advanced. Among these may be mentioned: (1) "clumps of bacteria" may circulate with the blood corpuscles and plug small terminal arteries in the brain; (2) primary localization of the infection may occur in the lungs or at some site on the systemic side of the circulation, whence new metastases may pass to the brain; (3) emboli may pass through a patent foramen ovale. In connection with temporary pulmonary localization it will be noticed that the patient in Case 5 showed definite lung signs several days prior to her seizure. The third theory awaits autopsy confirmation. Whatever the exact mechanism of the metastasis, its occurrence is attested by numerous necropsy studies and its actuality must be conceded.

Puerperal hemiplegia from cerebral embolism is characterized clinically by its sudden onset, by the coexistence of valvular heart disease or thrombotic processes in the pelvis or thigh, and by the slighter degree and shorter duration of the coma. Many patients are in the earlier years of the child-bearing period. Cases secondary to pelvic foci naturally occur later in the puerperium when puerperal septic processes have had time to assert themselves.

CASE 4.—A married Russian woman, age 28, was admitted October 3, 1927, complaining of paralysis of the left arm and leg of thirteen months' duration. At 15 she had had acute rheumatic fever being in bed a month with high temperature and painful swelling of one knee. Other past history irrelevant.

One year prior to admission, when in the last month of her fourth pregnancy (about twenty days before the expected confinement), the patient was suddenly seized with paralysis of the left face and the left upper and lower limbs with partial loss of consciousness. For two weeks she was aphonic and recognized no one. At the end of this period she underwent an easy, spontaneous delivery of a normal living child. After delivery consciousness returned, but the face paralysis persisted for three months and the arm and leg paralysis to the time of admission. For the previous two months she had been noting swelling of the ankles, most marked in the evening.

Examination revealed the following positive findings: Heart definitely enlarged to the left with palpable presystolic thrill; loud, rough presystolic murmur at apex and base. Spleen palpable, liver enlarged. Fingers distinctly clubbed. There was moderate muscular atrophy of left upper and lower limbs. Left upper limb spastic with power diminished, especially in extensors of hand. Left lower limb also spastic with slight impairment of motion. Tendon reflexes were much exaggerated on the left side with patellar and ankle clonus present. Wassermann negative.

*Final Diagnosis:* Embolism of middle cerebral artery, rheumatic cardiovascular disease with mitral stenosis and insufficiency.

CASE 5.—A married Chinese woman, age 40, a secundigravida, was admitted on the morning of September 8, 1926, on account of prolonged and ineffectual labor. The patient's one previous pregnancy had been terminated by an operative delivery done by native "physicians" in which the baby, born dead, had been severely mutilated and the maternal soft parts extensively damaged. Upon examination dense cicatricial atresia of the vagina was found barely permitting the passage of a 16 French catheter. Cesarean section was done shortly after admittance.

The patient ran a febrile course following operation, the temperature reaching 38 daily. On September 12 she developed a cough with thick purulent sputum. The lungs showed slight dullness at left base with diminished breath sounds and occasional crepitant râles. The condition was thought to be an acute respiratory infection. On September 20 (the twelfth day) at 1:20 A.M. when the baby was brought to breast, the patient was found semiconscious. She recognized neither the child nor the nurse and could not talk. She was incontinent of urine and feces. The following morning her mental condition remained the same; the temperature had reached 39.8. Examination showed marked weakness of right lower face and of the right extremities. Voluntary motion of the right arm was distinctly impaired, of the right leg slightly so. Tendon reflexes present and about the same on both sides. The semicomatose condition persisted for a week, at the end of which period, control of the spinetters returned, consciousness became clearer and the paralyses gradually subsided. Upon discharge on November 8, (30 days after delivery) the patient seemed free of hemiplegic symptoms.

Condition one year after delivery: No neurologic symptoms or signs.

*Final Diagnosis:* Embolism of middle cerebral artery from thrombotic focus in pelvis.

The prognosis of puerperal embolism is somewhat better than that of hemorrhage and thrombosis and the sixteen cases secondary to endocarditis which are reviewed by Hösslin include only two with fatal termination. When puerperal thrombosis is the primary issue, the pelvic process rather than the cerebral may be the cause of death. In many instances the hemiplegia is transitory, lasting only a few hours or days and may even be mistaken for hysteria.

#### UNCLASSIFIED CASES

It has not seemed advisable to classify the following cases since neither was seen until long after the paralysis had been established and the histories, as well as the findings, were inconclusive.

CASE 6.—A married Chinese woman, age 27, was admitted on February 21, 1927, complaining of stiffness of and inability to use the right arm and leg. One year prior to admission the patient delivered spontaneously a living child; the last three months of the pregnancy were said to have been complicated by headache, vertigo and marked edema of the face and extremities. On the fifth day of the puerperium, the patient became suddenly comatose (without convulsions) and remained so for three hours. Upon regaining consciousness, she found herself unable to speak and unable to move the right arm and leg. Both the aphasia and the paralysis were practically complete for one month. Gradual improvement then ensued, particularly in the ability to speak. During the six months prior to admission, however, the condition had remained stationary.

Examination revealed marked spasticity of the right upper and lower limbs and complete loss of function of the right hand and fingers. Movement of the right



elbow, shoulder, toes, knee and hip were distinctly impaired. Gait spastic. Speech indistinct and slurred. No anatomic heart disease could be detected. Wassermann negative.

*Impression:* Possibly cerebral embolism.

CASE 7.—A married Chinese woman, age 29, was admitted on September 16, 1927, complaining of paralysis of the left upper and lower limbs, of sixteen months' duration. In January, 1926, she underwent an apparently normal delivery in the care of a native Chinese midwife. Following confinement she continued for three months to have "excessive vaginal bleeding with clots." She was said to have been very weak during this period but was not thought to have had fever. Toward the end of the three months the left face and the left upper and lower limbs became gradually paretic. There was no loss of consciousness, no convulsions and no speech defect. The patient was unable to walk until nine months after delivery and then awkwardly. A year after confinement she suffered a convulsive seizure lasting twenty minutes, probably Jacksonian epilepsy.

Examination showed grip of left hand very weak with complete loss of finger motion. Wrist, elbow and shoulder movements on left were markedly impaired; the left arm and fingers were kept flexed. The left lower limb was slightly spastic with considerable loss of power; the toes could not be moved. Tendon reflexes were exaggerated in the left upper and lower extremities. Gait spastic. Sensation to brush, touch and pin prick was decreased on the left side, including the face. Wassermann negative.

*Impression:* Probably cerebral thrombophlebitis.

Therapeutic measures in puerperal hemiplegia unfortunately yield scant results and are limited to symptomatic treatment in the attack and physiotherapy during the chronic stage. Massage and active or passive motion are of course contraindicated if there is the slightest likelihood of embolic detachment. In some cases electrical stimulation seems to hasten the return of function, but the most important element in the chronic stage is probably time.

It is a pleasure, as well as a duty, for the writer to express his cordial thanks to Dr. Andrew H. Woods, Professor of Neurology, Peking Union Medical College, for his valuable advice throughout this study.

#### SUMMARY

Seven cases of puerperal hemiplegia were seen at the Peking Union Medical College Hospital within a period of four years. Six of the patients were Chinese women. Two cases were apparently due to cerebral hemorrhage, two to cerebral thrombophlebitis, and three to cerebral embolism.

Puerperal hemiplegia from brain hemorrhage usually comes on during or shortly after labor, probably always as the result of a co-existing toxemia of pregnancy. The mechanism of the hemorrhage is best explained on the ground that the toxemias of pregnancy produce structural damage to the vessel walls which become so weakened that the elevated blood pressure and the bearing-down efforts incident to labor cause rupture.

Puerperal hemiplegia from cerebral thrombosis, possibly the most common type of the condition, occurs most often in the second or third week of the puerperium. It is probably always secondary to a pelvic infection, although the latter may be so slight as to escape detection. In many instances the cerebral thrombosis is preceded by a toxemia of pregnancy and it is suggested that here, as in cerebral hemorrhage, vessel damage may play an important etiologic rôle. Certain changes in the colloidal state of the blood further augment the tendency to thrombosis in the puerperium.

Puerperal hemiplegia from cerebral embolism may be due either to detached cardiac vegetations or to emboli of pelvic origin. The former probably represents a coincidence not directly related to the puerperal state. The mechanism by which detached pelvic thrombi may reach the brain through the pulmonary capillaries is obscure, but numerous necropsy studies attest its occurrence and its actuality must be conceded.

Although the seven cases of this report all survived, the prognosis of puerperal hemiplegia is usually grave. Cerebral hemorrhage occurring during labor is particularly likely to prove fatal. Patients who survive the apoplectic seizure seldom escape a certain degree of permanent paralysis.

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# OBSERVATIONS ON THE NATURE AND ORIGIN OF THE LOWER UTERINE SEGMENT FROM A STUDY OF FRESH UTERI OF WOMEN DYING DURING PREGNANCY, LABOR, AND EARLY PUERPERIUM

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THE controversy about the origin of the lower uterine segment is not yet settled.

In 1872, Braune, from a study on frozen sections of a woman who died in the second stage of labor described what is now called Braune's contraction ring which, during the second stage of labor, divides the uterus into the upper contractile portion and the lower passive segment. Its site is indicated by "a large vein and by the deflection of the peritoneum from the anterior surface of the uterus." (Williams) Identifying the ring as the internal os, he naturally reasoned that the lower segment was made up entirely by the cervix.

In his work on ruptures of the uterus, Bandl in 1875 showed that uterine rupture during labor always occurred in the lower uterine segment. And noting the extreme disparity in size between the large lower segment which was eleven or more centimeters and the small undilated cervix during pregnancy, he questioned the possibility of the assertion of Braune that in the few hours of labor the small cervix which is 2.5 to 3.5 cm. long, can assume the large dimensions of the lower segment. He believed that if the lower segment is formed by the cervix, preparatory changes in the latter must occur during pregnancy whereby its outer portion is gradually shifted up into the body of the uterus. This complicated explanation of Bandl is no longer accepted but his paper gave rise to a voluminous literature concerning the origin and nature of the lower uterine segment.

Up to this date, there are two main views on the subject. The first states that the contraction ring represents the internal os and that the lower segment is entirely composed of cervical tissue. The sponsors of the second view lay particular stress on their belief that the main bulk of the lower segment is made of uterine tissue; and that only the lower part to the height of three to four centimeters above the dilated external os corresponds to the cervix. Bandl, Küstner, Bayer and others support the first theory, while Schroeder, Ruge, von Franque, Barbour, Veit and Zweifel uphold the second view.

Unfortunately, as Williams states in the latest edition of his textbook on obstetrics (1924) the supporters of these two theories base their arguments on uteri that had been frozen for some time when the delicate structure of the mucosa or decidua could not longer be identified.

The research herewith presented is based on the anatomic and histologic study of sixteen uteri classified as follows:

From virgins	4
From nonpregnant middle-aged parous women	3
From a nonpregnant 70 years old	1
From a woman who died 1 day after cesarean section	1
From a woman who died 5 days after cesarean section	1

From a woman who died 5 days after a 3 months abortion	1
From a woman who died on the 23d day of puerperium	1
From a woman who died during the first stage of labor with the fetus in situ	1
From women dying in the first stage of labor and whose babies were delivered by postmortem cesarean section	2
From a woman who died 2 hours after the third stage of labor	1

In view of the vague and incomplete descriptions in the available literature regarding certain points on the anatomy and peritoneal rela-

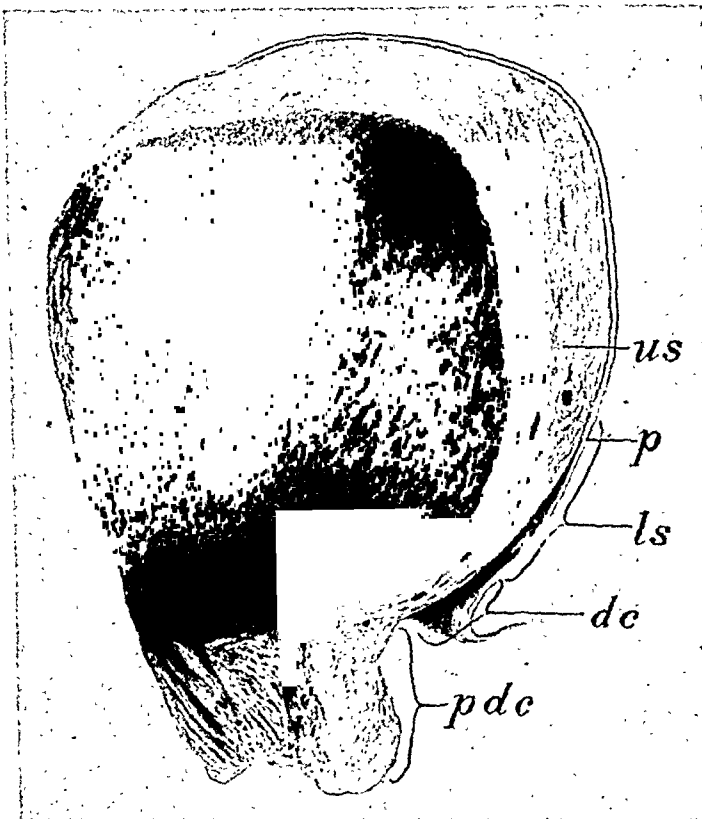


Fig. 1.—Specimen I is the uterus of a woman who died during the first stage of labor. The baby was delivered by postmortem cesarean section. The cervix during life could hardly admit two fingers. The upper part of the fundus and the right anterior quarter of the anterior wall had been cut off. *us*, Upper segment. *p*, Lowermost intimate attachment of peritoneum. *ls*, Lower segment. *dc*, Dilated cervical canal. *pdc*, Partially dilated cervix.

tions of the uterus, a study of the fresh nonpregnant organ was undertaken in order to identify its different structures when under the influence of pregnancy, labor or puerperium. From these observations on the nonpregnant uterus, the landmarks which I consider as fixed lines of division of the three different portions of the uterus are as follows:

1. The upper segment is that portion of the uterus from the fundus down to the lowermost level of intimate attachment of peritoneum on the midline of the anterior wall. Usually this is near a cross-section of a blood vessel. Its mucosa, at the upper portion, has a few low small folds which are more appropriately called irregularities of the mucosa.

2. The isthmus begins from the level of the lowermost attachment of the peritoneum on the anterior wall down to the level of the cervical mucosa. It measures from 0.7 to 1 centimeter in length. Its walls are thinner and softer than either the upper segment or the cervix. I believe it is the part of the uterus, which on compression gives rise to Hegar's sign. The mucosa that covers the anterior and posterior walls of this portion is smooth and even without fold markings.

3. The cervix is the structure below the upper level of the cervical mucosa or histologic internal os which corresponds posteriorly to the lower level of the thick oblong-shaped peritoneum which is intimately adherent to the isthmus uteri. The posterior vaginal attachment corresponds to the point just above the junction of the middle and lower third of the posterior cervical wall. Anatomically, its mucosa is distinguished by the well marked longitudinal and oblique folds called *plicae palmatae*.

We may now study the effect of pregnancy and labor on the uterus.

Specimen I (Fig. 1) is a uterus of a primipara who died of eclampsia in the first stage of labor. Just before death, the cervix could hardly admit two fingers.

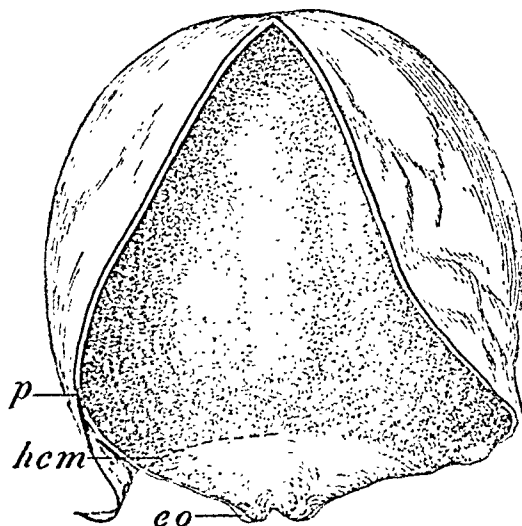


Fig. 2.—Diagrammatic drawing of Specimen II which is the uterus of a woman who died undelivered during the first stage of labor. The uterus was preserved with the fetus and placenta in situ. Notice the obliterated internal os, the stretched *plicae palmatae* of the dilating cervical canal, and the narrow external os.

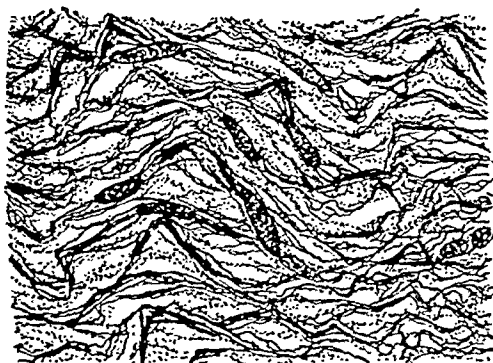
The baby was delivered by postmortem cesarean section. In general, this uterus may be said to consist of four portions namely:

- (a) An upper thick well contracted portion which represents the upper segment.
- (b) A softer and thinner wall which represents the lower segment of the pregnant uterus or the isthmus uteri of the nonpregnant. This wall is lined by decidua. The line of separation between the two portions is the lowest limit of the intimate attachment of the peritoneum to the uterus and a cross-section of a vein on the uterine wall. Posteriorly, the upper border of this portion corresponds to the upper border of the oblong-shaped thick peritoneum covering the lower segment.
- (c) A thin, soft, velvety portion with evidences of stretched *plicae palmatae*. It is thinly covered by decidua but in some of its portions folds of the *plicae palmatae* extend as high as its upper border. Posteriorly, the upper border of this portion corresponds to the lower border of the thick oblong-shaped peritoneum intimately attached to the lower segment.
- (d) This consists of the partially dilated cervix. It is constricted at its upper

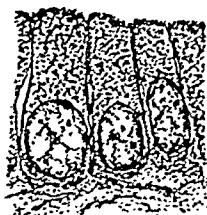
border and its mucosa is thrown into large folds which are the hypertrophied but not yet much stretched plicae palmatae.

The measurements of the different portions are as follows:

a. Length upper uterine segment -----	9.0	cm.
Thickness upper uterine segment -----	2.1-2.8	cm.



*c*<sup>2</sup>



*e*<sup>2</sup>

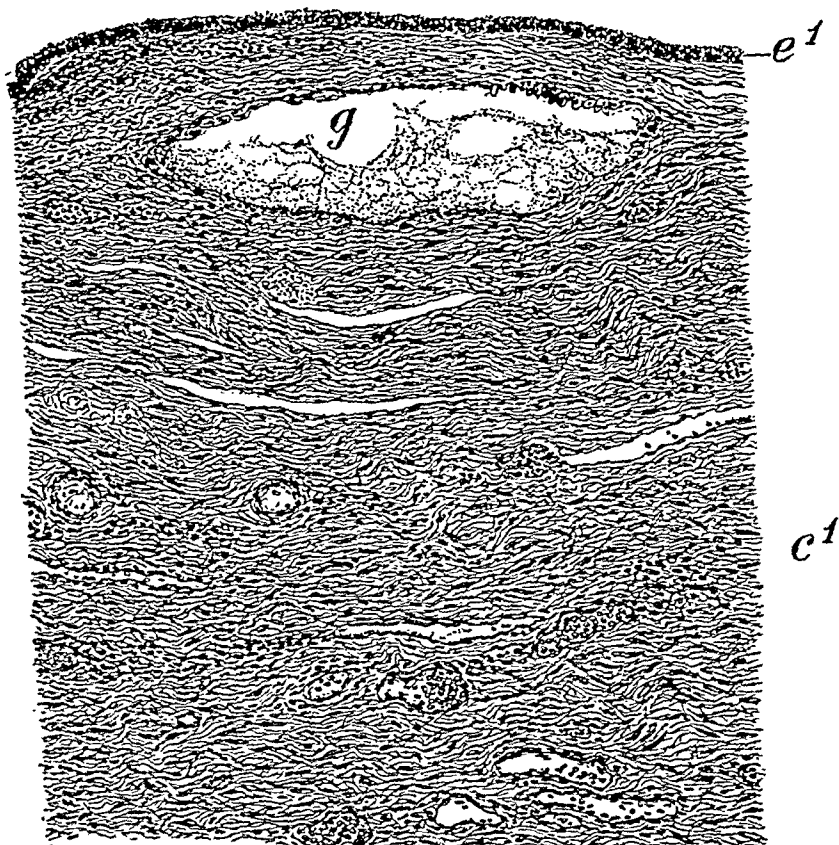


Fig. 3.—Section from Specimen II cut at upper level of the dilated cervical canal at a height of 7 cm. above the external os. *e*<sup>1</sup>, Epithelium. *c*<sup>2</sup>, The same epithelium magnified. *g*, Cervical gland. *c*<sup>1</sup> and *c*<sup>2</sup>, Connective tissue. Note the preponderance of loose wavy connective tissue stroma cells.

b. Length lower uterine segment -----	4.9	cm.
Thickness lower uterine segment -----	1.5-2	cm.
c. Length dilated cervical canal -----	1.1	cm.
Thickness dilated cervical canal -----	0.6-1.5	cm.
d. Length partially dilated cervix -----	4.5	cm.
Thickness partially dilated cervix -----	2.0	cm.

The vaginal attachment is pushed downwards so that posteriorly it is attached at 1.7 cm. above the external os.

Specimen II (Fig. 2) is a uterus of a full-term pregnant young primipara who died after having convulsions and semiconsciousness for seven hours. Clinically, the head was engaged, and the lower cervical canal closed.

The uterus looks like a big elongated balloon with thin walls. The measurements of its different portions are as follows:

Length, upper segment (from fundus to lowest level of intimate attachment of peritoneum on anterior wall)	23.0 cm.
Length, lower uterine segment (from lowest level of intimate attachment of peritoneum to level of cervical mucosa)	5.0 cm.
Length partially dilated cervical canal	5.5 cm.

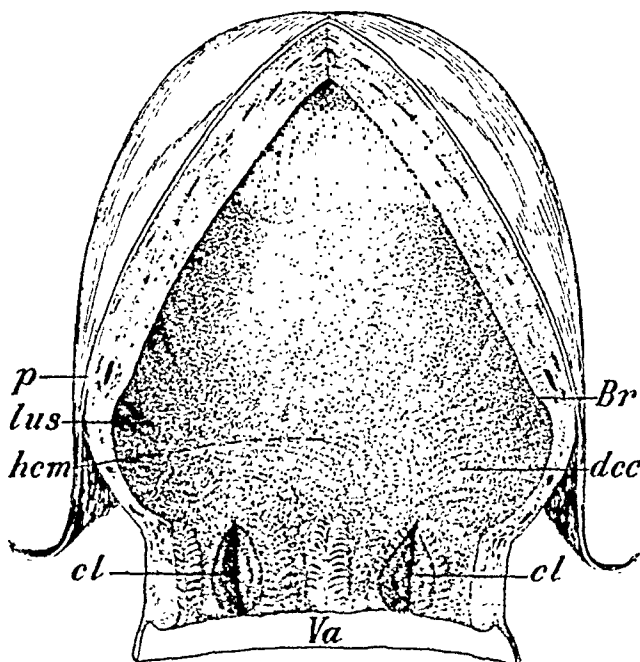


Fig. 4.—Diagram of Specimen III which is the uterus of a woman who died from hemorrhage due to forcible delivery through an incompletely dilated cervix which could admit only  $3\frac{1}{2}$  fingers. The dilatation of the cervix is more advanced than in Specimen I, Fig. 3. Notice the obliteration of the internal os and the bilateral cervical laceration at *cl*. The level of the lowermost intimate attachment of peritoneum corresponds to *p*. *Br*, Braune's ring. *lus*, Lower uterine segment. *hcm* represents the height or upper level of the cervical mucosa. *dcc*, Dilated cervical canal.

Grossly, the cervical canal is identified by the glistening white cervical mucosa with the stretched plicae palmatae. Its upper border corresponds to the lower border of the thick oblong shaped peritoneum posteriorly. Microscopically this portion is identified by the cervical epithelium and glands (Fig. 3). Length of the undilated cervical canal, 1.5 cm. This portion does not admit one finger. The posterior vaginal attachment is 1.5 cm. above the external os.

The cavity formed by the lower segment and the cervix is like that of a funnel wide in its upper portion, which gradually narrows until the stem of the undilated cervix is reached. No constriction is found at the (histologic) internal os.

This specimen is a beautiful illustration of the belief that the dilatation of the cervix occurs gradually from above downwards. The histologic internal os may be obliterated and yet the lower cervical canal with the external os is still closed.

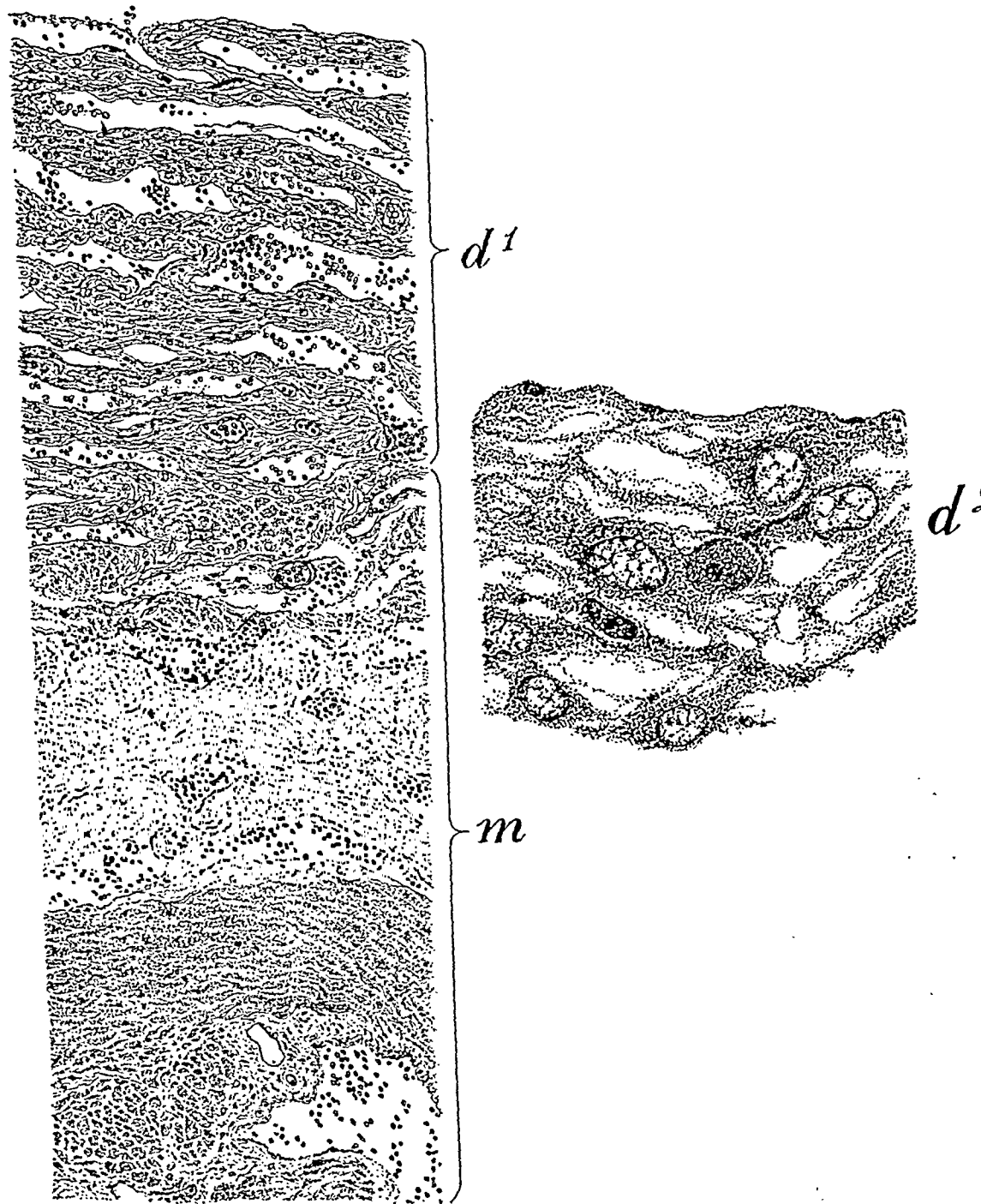


Fig. 5.—Section from Specimen III of the uterine wall below Braune's ring but above the upper level of the dilated cervix. *d*<sup>1</sup>, Decidual lining. *d*<sup>2</sup>, Magnified decidual cells. *m*, Part of muscular wall. Note the preponderance of muscular tissue. Compare it with Fig. 3.



Specimen III (Fig. 4) is a uterus of a woman who died from hemorrhage due to a forcible delivery through an incompletely dilated cervix. (Dilatation, over 3 fingers.) The uterus measured from the fundus to the external os, 27.2 cm.

Its interior is divided distinctly into three portions namely:

- a. An upper thick well contracted segment with a suggestion of a ring in its lower part 15.4 cm.
- b. A soft thin yielding portion of which the upper 4 cm. is covered by decidua and the lower 3.7 cm. is lined by the cervical mucosa 7.7 cm.
- c. A thicker partially dilated cervix with a bilateral laceration—  
The upper border of this portion is constricted 4 cm.

The lower thick border of the upper segment corresponds to the lowermost point of the intimate attachment of the peritoneum on the anterior wall, and also by a cross-section of a large vein.

The lower segment begins above as a widely irregular groove below the ring formed by the lower border of the thick upper segment. On examining it closely, it is found that the upper 4.0 cm. of its extent is entirely covered by decidua with no traces of plicae palmatae. Below this level, however, the wall is thinner, softer and more velvety than the upper portion. It is lined by the glistening cervical mucosa with its much stretched plicae palmatae. Evidently this constitutes the cervical canal that has joined in the formation of the lower segment. It measures 3.7 cm. Its upper border corresponds to the lower level of the oblong-shaped thick peritoneum posteriorly. The internal os is entirely obliterated but a constricting ring is found at the upper level of the undilated cervical canal.

The above specimens show that—

1. The isthmus of the nonpregnant uterus elongates and, in marked contrast with the upper segment, it undergoes thinning and softening during labor. The difference in consistency of the two portions increases as labor becomes further advanced, thereby giving rise to the contracted abdominal ring above what was originally the isthmus.

2. The cervix during labor not only dilates but also elongates, reaching the length of 7 or over 7 cm. The dilated portion undergoes thinning and softening to a far greater extent than the lower segment of the uterus. Once the internal os becomes obliterated, no sign of constriction exists at its original site during the first stage and probably also during the second stage of labor. During the first stage, the only place of constriction in the cervix is at the upper level of the undilated or partially dilated cervical canal. Braune's contraction ring develops toward the latter part of the first stage of labor and possibly becomes most marked during the second stage of labor.

3. The isthmus uteri and the cervix enter into the formation of the lower passive segment during the first and second stage of labor, and contrary to the prevailing view, the cervix forms a far greater proportion than the isthmus in the structure of the fully developed lower passive segment. In none of the specimens above does the cervix measure less or even equal the length of the lower uterine segment

proper. The lower uterine segment is relatively long before the cervix dilates. But as the dilatation and consequent elongation of the cervix progresses, the lower uterine segment becomes correspondingly shorter.

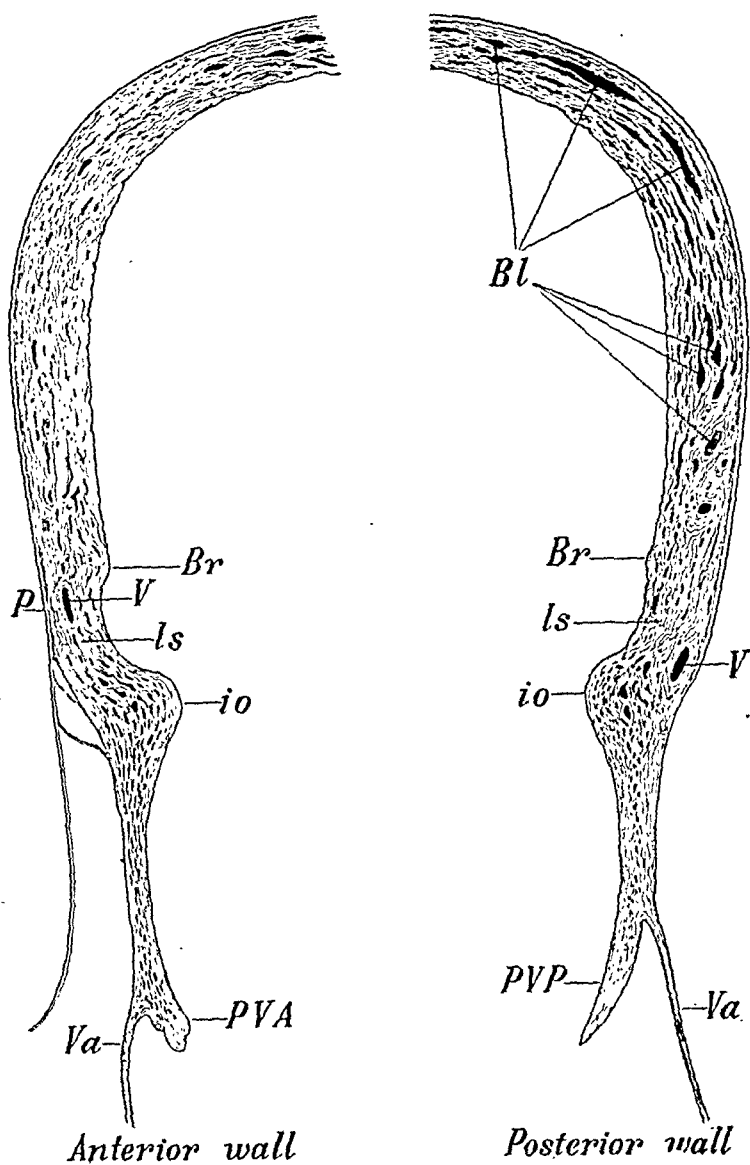


Fig. 6.—Diagram of the midlongitudinal section of the anterior and posterior walls of Specimen IV which is the uterus of a woman who after twelve days of ineffectual labor due to transverse presentation was delivered by internal podalic version. The patient died three hours after the third stage. *Br*, Braune's ring. *V*, Vein. *P*, Lowermost intimate attachment of peritoneum. *io*, Internal os. Notice the relative shortness of the lower uterine segments in comparison with the long cervix. *PVA*, Portio vaginalis anterior. *Va*, Vagina. *PVP*, Portio vaginalis posterior. *Bl*, Blood vessels. Note the indistinct Braune's ring at lower level of intimate attachment of peritoneum and the marked contraction of the internal (histologic) os. Note also the preponderance of muscular interspaces at the lower segment and upper part of the cervix, especially on the anterior wall.

4. Specimen I (Fig. 1) shows that decidual cells may extend as far as the upper part of the cervix. In such a case, the lower level of the thick, oblong-shaped peritoneum may help to determine the upper border of the cervix.

Specimen IV (Fig. 6), is the uterus of a woman who after twelve days of ineffectual labor due to transverse presentation was finally delivered by internal podalic version. The patient died about three hours after the third stage of labor.

The uterus is divided into a distinctly thick hard upper portion and an extremely thin soft lower portion by a well marked contracted ring. The upper portion measures 14.7 cm. long and is covered by decidua and the lower thin portion which is 7.8 cm. long is covered by the much stretched smooth glistening but swollen looking cervical mucosa. The plicae palmatae are entirely unfolded and no reduplications of the mucosa can be seen. The upper part of the dilated soft canal below the ring is pierced by many cavities which look as if they are intermuscular spaces. In the lower half, the tissue becomes more dense and the intermuscular spaces are not so prominent. Specially this is true at the lower part beginning at the posterior attachment of the vagina to the cervix which attachment in this specimen, is 3.5 cm. above the external os.

The contracted ring is 2.5 cm. below the lowermost intimate adhesion of peritoneum on the anterior wall is a cross-section of a large vein and a low in-peritoneum from the anterior surface of the uterus), and posteriorly, it corresponds to the lower level of the much stretched oblong-shaped thickened peritoneum. No decidual tissue is found below the ring. A microscopic section of the tissue just below the ring is shown in Fig. 7. It is a typical specimen of the cervical mucosa. From this, the ring is identified as the contracted histologic internal os and all the tissue below it which is 7.8 cm. long corresponds to the cervix.

On closer examination of the upper thick portion of the uterus, it is found that from the lowermost intimate attachment of the uterovesical peritoneum or the level of its anterior deflection down to the well marked ring, the uterine wall is slightly thinner and softer than the portion above it. This slightly thin and soft portion as well as the markedly contracted ring which represents the histologic internal os is riddled with many intermuscular spaces in the same manner as is found in the upper half of the soft dilated canal. At the level of deflection of peritoneum on the anterior wall is a cross-section of a large vein and a low indistinct ring formed by the thicker upper portion.

Is this upper low indistinct ring Braune's contraction ring?

Since its site corresponds to the level of deflection of the uterovesical peritoneum and to the cross-section of a large vein—the two landmarks given by Braune—it must be the ring to which he referred.

But why is it that the ring he described, as well as the ring of Williams' frozen section, was marked and the only one present in the uterus, while in my specimen Braune's ring is low and indistinct but with a marked contraction ring corresponding to the histologic internal os?

It must be borne in mind that his (Braune), as well as Williams', specimen are frozen sections of women who died undelivered during the second stage of labor, while my specimen is from a woman who died after the completion of the third stage of labor.

Specimens I, II, and III of this paper show that during labor the isthmus or lower segment of the uterus becomes thin and soft in marked contrast with the thick upper segment and that as labor

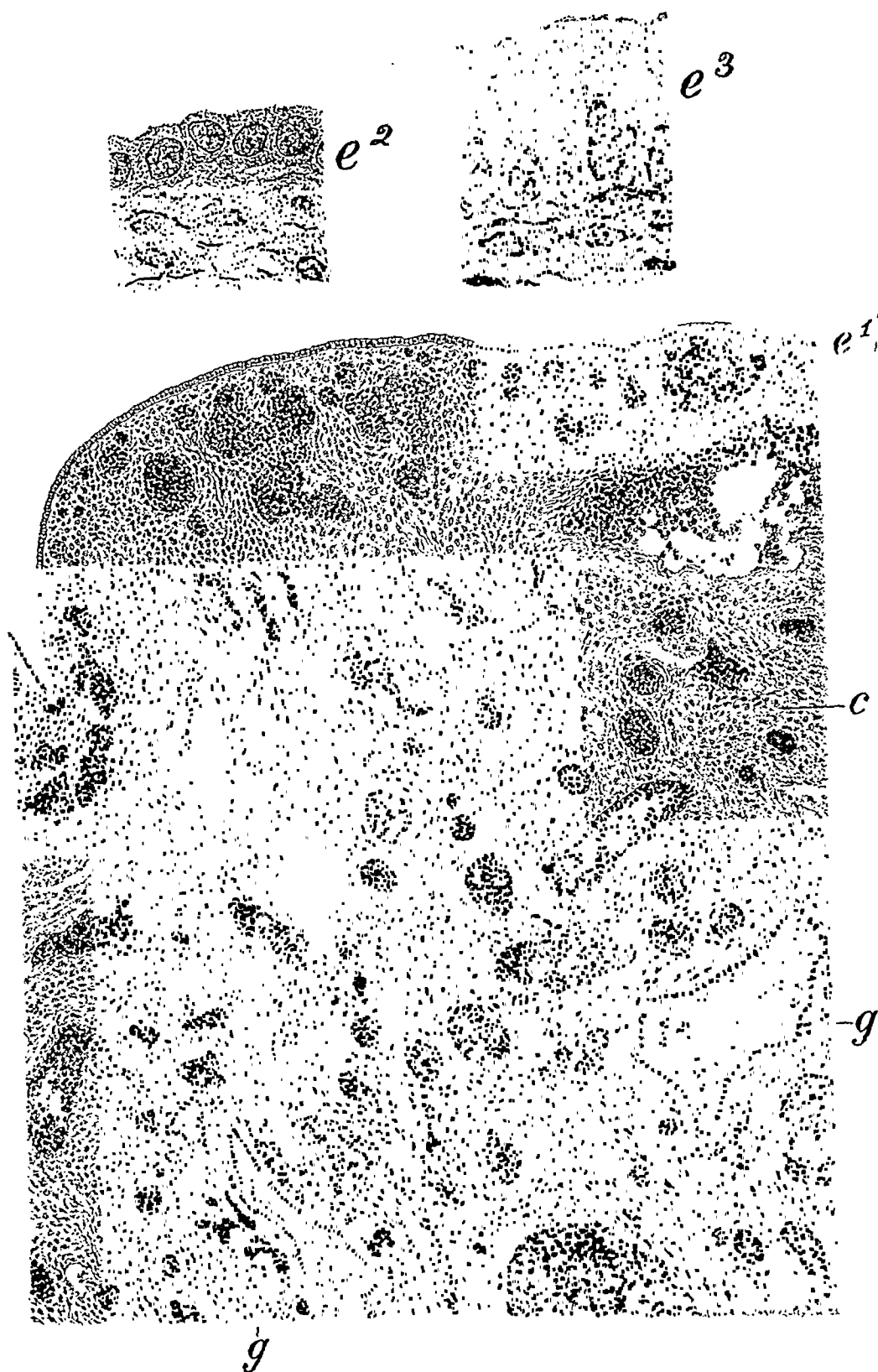


Fig. 7.—Section taken from Specimen IV, Fig. 6, just below the markedly contracted ring representing the internal os or at a level of 7.7 cm. above the external os. Only the inner part of the wall is drawn. *e¹*, Cervical epithelium. *e²* and *e³* are the magnified cervical epithelial cells taken at different portions. *c*, Connective stroma cells of the cervical mucosa. *g*, Cervical glands. Compare it with Fig. 3 and notice that the stroma cells and the blood vessels and glands do not have the flattened appearance as shown in Fig. 3. Compare it with Fig. 8.

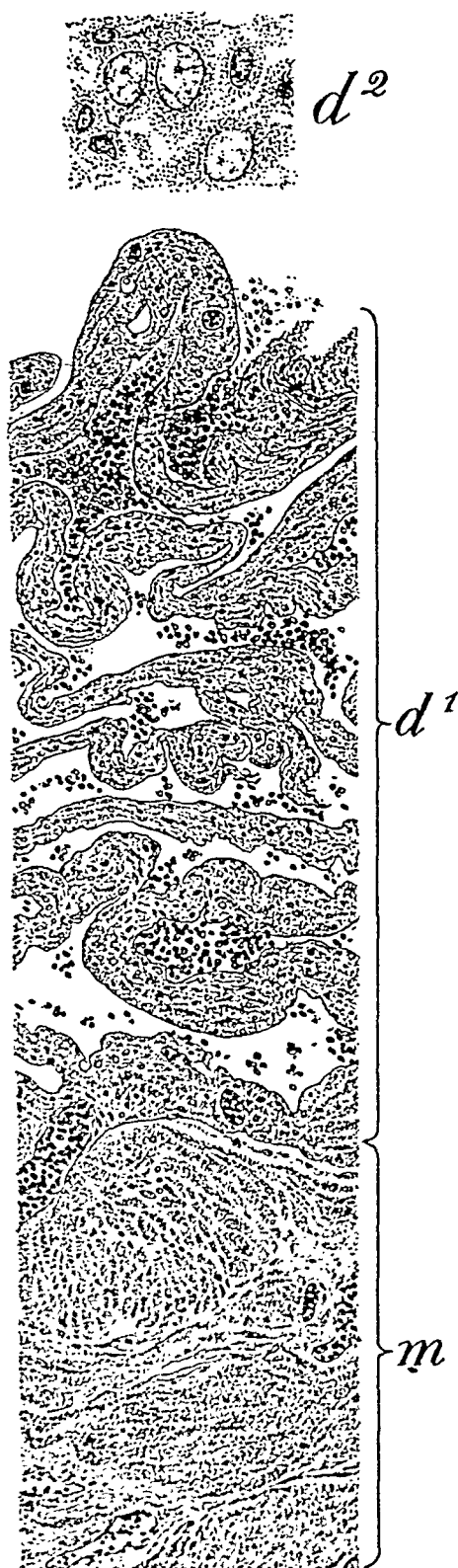


FIG. 8.—Section of the lower uterine segment just above the internal os. From Specimen IV, FIG. 6. *d¹*, Decidua. *d²*, Magnified decidual cells. *m*, Part of the muscular wall. Note the decidual lining and the preponderance of muscular tissue in the rest of the wall. Compare this with Figs. 3 and 7.

approaches the second stage, the lower border of the upper segment develops into a ring, while the internal os becomes completely obliterated and shows no evidence of constriction.

Specimen IV, Fig. 6, shows that at the termination of the third stage of labor, the internal os becomes again constricted, while Braune's ring becomes indistinct.

In the light of the above findings, it appears that before the expulsion of the child, the strong effort of the upper segment to expel it develops gradually the formation of Braune's contraction ring which marks the lower border of the upper active segment. This is true especially in prolonged difficult labors. The dilated cervix and the lower uterine segment form one common passive canal undivided by constriction. After the expulsion of the child, however, the lower segment, which has not lost its power of action, quickly contracts together with the upper segment while the dilated cervix remains comparatively stationary. This brings about the rapid formation of a marked lower ring which represents the histologic internal os and the blurring of Braune's contraction ring after the third stage of labor. The slower contraction of the cervix after the second and third stages of labor may be explained by the relatively great predominance of connective and elastic tissue in its structure in striking contrast with the greater muscular preponderance in the lower uterine segment.

The different sites of the marked ring according to whether the uterus is seen during the latter part of the first or during the second stage, or after the completion of the second or third stage of labor, furnishes substantial ground for the support of each of the two theories regarding the origin of the lower uterine segment. Each theory is correct according to the time and condition of the uterus examined.

If the well-marked ring is found during the second stage before the complete expulsion of the child, and it corresponds to a section of a large vein on the uterine wall and to the lowermost intimate attachment of the peritoneum on the anterior uterine wall, it must be Braune's contraction ring and the structure below it is the lower segment of the uterus and the cervix.

But if the well-marked ring is found after the completion of the second or third stage of labor in a uterus whose cervix had undergone the process of complete dilatation, and if this ring is below and not at the level of the lowermost attachment of the peritoneum and it corresponds to the peritoneal landmark posteriorly, and if the structure just below it is lined by the cervical mucosa, it cannot but represent the histologic internal os, and all the structure below it, which is from 7 to 8 cm., corresponds to the cervix.

## CONCLUSIONS

1. During the second stage of labor, the fully formed lower passive segment which begins from Braune's ring (which corresponds to the lowest level of intimate peritoneal attachment to the midanterior wall, and to the cross-section of a large vein to the external os), is formed by both uterine and cervical tissue, and that the cervix forms a much greater proportion than the uterus.

2. After the termination of the second stage of labor, the lower uterine segment proper contracts in unison with the upper segment, while the dilated cervix remains comparatively stationary. This brings about the gradual effacement of Braune's ring and the marked development of the contracted internal os.

3. The dense tissue in the lower 3 or 4 cm. of the dilated soft canal, which other authors claim to represent the entire structure of the cervix, is in truth less than half of the whole dilated cervix. It corresponds to the cervical canal from the external os to the level of the posterior attachment of the vagina.

4. While the demonstration of the cervical mucosa is a *prima facie* evidence of cervical tissue, its absence does not always preclude cervical structure, for decidual cells may sometimes extend to the upper part of the cervix. In these cases, the posterior peritoneal landmark should be used to determine the extent of the cervical canal.

I wish to thank the members of the Pathological Department, University of the Philippines, especially its Head, Dr. L. Gomez, for their kind help and for giving me all the facilities to make this investigation possible. Thanks are also due to Dr. J. K. Santos for the reproduction of the microscopic sections and to Mr. Ligaya for the illustration of the gross specimens.

1002 TAFT AVENUE.

# THE RETICULO-ENDOTHELIAL CELLS OF THE UTERUS: AN EXPERIMENTAL STUDY

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THE following report comprises a series of experiments which were performed to determine the occurrence of phagocytic mononuclear cells in the uterus of the rabbit under normal conditions, during pregnancy, and in inflammation. These results were then compared with the data available in the literature and from the examination of a number of human specimens in order to ascertain to what extent they may be applicable to human subjects.

## INTRODUCTION

Although the finding of bacteria within white blood cells was mentioned by a number of observers as early as 1870 (Oertel,<sup>1</sup> Klebs,<sup>2</sup> Waldeyer,<sup>3</sup> and others), credit for first describing the process of phagocytosis must be given to Metschnikoff,<sup>4, 5</sup> who published his first paper on the subject in 1883 and in succeeding years elaborated his famous theory. Metschnikoff believed that most phagocytes circulate in the blood and lymph, and that there are two main types. The first group he termed *microphages* and comprise the polymorphonuclear leucocytes, while to the second group belong the *macrophages* which are larger mononucleated cells also found in the circulation but intimately associated with macrophages in the tissues of organs such as the spleen, the lymph nodes, and bone marrow. The microphages, he believed, are especially concerned in engulfing bacteria causing acute inflammatory conditions, and have a greater power of motility so that if a local inflammatory irritation is set up in a tissue either with bacteria or the introduction of a foreign body, they are the first to appear on the scene. The macrophages, on the other hand, do not reach the inflamed area until later, and they by preference phagocytize animal cells, such as blood cells and the bacteria of such chronic diseases as leprosy or tuberculosis.

In 1890 Ranvier<sup>6</sup> described certain large branching cells with oval nuclei and finely granular protoplasm occurring in connective tissues and especially in the omentum, which he termed *clasmatocytes*. He believed that they serve as carriers of nutritive material to the tissues and are descendants of white blood cells. Under the influence of an inflammatory irritant, they may become markedly phagocytic and again become transformed into leucocytes. The work of Marchand<sup>7</sup> tended to show that these cells are not descendants of white blood cells but arise from mesenchymal elements in the connective tissues, and under the influence of an inflammatory irritant they coincide with the macrophages of Metschnikoff. He named these cells "adventitial cells" and referred to them as "leucocytoid cells," because he also believed that they give rise to leucocytes. Mallory<sup>8</sup> in his studies on typhoid fever described similar large phagocytic cells and considered them as originating from lymphatic or vascular endothelium, and hence termed them "endothelial leucocytes."

Other workers joined the field and described these large mononuclear phagocytic cells under a variety of different names, for instance, Renault<sup>9, 10</sup> referred to them



as *cellules rhagiocrines*, Dominici,<sup>11</sup> as *cellules lympho-conjonctives*, and Weidenreich,<sup>12</sup> as *polymorphous histiogenic wandering cells*. Maximov<sup>13, 14</sup> in his extensive studies on aseptic and purulent inflammation gave them the name of *polyblasts* and showed the important part they play in inflammatory reactions.

Further developments in the study of these cells were then made possible by the institution of vital staining. Ribbert<sup>15</sup> in 1904 was the first to use lithium carmine for intravital studies and showed that many cells of the body took up this dye specifically. He was able to demonstrate the wide distribution of these specifically staining cells in the connective tissues of the body and that the dye was also taken up by the endothelial and reticulum cells of the spleen, bone marrow, lymph nodes, the Kupffer cells of the liver, and reticulum cells of the thymus. Bouffard<sup>16</sup> shortly afterwards demonstrated that these cells could be stained intravitaly with the benzidine dyes. Extensive work was then done by Goldmann<sup>17, 18</sup> who showed that the vitally stained cells were identical with the macrophages of Metschnikoff, the clasmatoocytes of Ranvier, the polyblasts of Maximov, and the adventitial cells of Marchand. In 1913 Aschoff and his pupil Kiyono<sup>19, 20, 21</sup> began a series of reports of their exhaustive investigations and grouped the various cells of the body which stained vitally under the general term of reticulo-endothelial system. They employed the name *histiocyte* in referring to the mesenchymal mononuclear phagocytes which are found in the connective tissues.

In this brief introduction it is impossible to attempt any further summary of the tremendous amount of work that has been done on the various phases of this problem. Several hundred papers dealing with intra- and supravital staining and with the origin and function of reticulo-endothelial cells in health and disease have been published. The subject has been greatly confused by the lack of uniformity in terminology, and there are at least a score of different names applied to the cells in question by various observers. Moreover, many features are still in a state of controversy, especially in regard to the origin of the mononuclear phagocytes. Further information is available in several comprehensive reviews which have been compiled in recent years, by Aschoff,<sup>22, 23</sup> Jaffé,<sup>24</sup> Sacks,<sup>25</sup> and Foot.<sup>26</sup>

#### TECHNIC

In dealing with the female genital organs of the rabbit it is important to remember the anatomy of this animal's pelvis, since it differs from the other laboratory animals in common use (Drain<sup>27</sup>). The uterus is composed of two horns (*Uterus Duplex*) which enter the vagina without uniting so that there is no structure analogous to a corpus uteri. The intravaginal portions of the cornua measure approximately 1.2 cm. in length. The vagina may be considered as consisting of two parts. The upper, the *pars uterina vaginae*, extends from the fornix above to the vestibulum below. It measures from 7 to 8 cm. in length and for a distance of 5 to 5.5 cm. it lies in the abdominal cavity and is supported by the *ligamenta lata*. The lower part of the vagina, the *vestibulum vaginae*, begins at a level corresponding to the opening of the urethra.

The uterine horns are lined by a well developed mucosa which is drawn up into folds and is composed of a single layer of cubical epithelium. The subjacent *propria mucosae* contains numerous glands, and the musculature is made up of an outer longitudinal and an inner circular layer. The cavity of the *pars uterina vaginae* is also lined by a single layer of cubical epithelium which is continuous with that of the cornua above and undergoes a transition into the stratified

epithelium of the vestibulum below. The vaginal propria mucosae is devoid of glands, and the pars uterina has but a thin circular layer of smooth muscle.

The dye most consistently used for intravital staining in these experiments was trypan blue, although a number of animals were stained with lithium carmine. The former was administered as a 1 per cent aqueous solution, and the latter was prepared by adding 5 per cent by weight of carmin rubrum optimum (Grübler) to a cold saturated solution of lithium carbonate. This was then boiled for ten to fifteen minutes in a water-bath and filtered before using. These solutions were given intravenously (ear-vein) in from three to five daily consecutive doses so that each animal received approximately 0.2 grams per kilo body weight. The tissues were fixed in 10 per cent formalin and embedded in paraffin. The counterstain employed was either alum carmine or hematoxylin depending on whether the intravital staining had been carried out with trypan blue or lithium carmine.

The animals were killed in from twenty-four to forty-eight hours following the last injection. The organs were removed in toto, and after fixation sections were obtained from the upper part of the pars uterina vaginae so as to include the intravaginal portion of each horn and also from a lower level, from each cornu, and from one tube. As much of the ligamenta lata as possible was left attached so that this region could also be studied.

The cauterization was carried out by introducing a small glass tube, carefully lubricated, a distance of from two to two and a half inches per vaginam. A few drops of a fresh 20 per cent solution of silver nitrate was then allowed to run down the tube. This meant that the area cauterized included mainly the upper part of the pars uterina vaginae but at times also involved the openings and lower ends of the two cornua.

#### MACROPHAGES IN THE UTERI OF NORMAL RABBITS

. In order to determine the occurrence and distribution of macrophages in the walls of the uterus and vagina under normal conditions, a series of 15 rabbits were stained intravitaly and examined. These animals were chosen at random and represent considerable variation as to age and size, but as far as could be judged were in a healthy state.

The first factor to be taken into consideration was the number and distribution of the cells which took up the dye. Certain variations were then noted as the heavier older females, which had previously had one or more litters, showed the presence of many more cells than the smaller younger animals. In some of the latter many sections were found in which not a single cell with trypan blue could be noted. On the whole, however, it could be established that the presence of small numbers of macrophages in the rabbit's uterus and vagina is a fairly constant phenomenon. They are found isolated or in twos or threes scattered throughout the loose fibrillar tissues of the propria mucosae, in the lymph spaces of the musculature, and in the subserous tissues of the cornua and of the pars uterina vaginae. They are also noted in the fimbriae of the tube, and their maximal concentration is in the loose tissues of the ligamenta lata. Here, as in the omentum, they are constantly present and at times in very considerable numbers.

Although the work of Sabin and her collaborators<sup>28,29</sup> tends to show that two definite types of mononuclear phagocytic cells occur in the connective tissues of the body and that these can be demonstrated by supravital staining, it has been found impossible to differentiate them with certainty in animals intravitaly stained. As they appear in sections from the uteri of the rabbits in this series (Figs. 1 and 2), the individual macrophages show considerable variation, although this is not as marked as in pathologic conditions or during pregnancy. In size they range from 15 to 30 micra and they usually present a round or oval outline, although they may be spindle-shaped, elongated, or may branch in one or more directions. The nucleus is usually round or oval but is at times irregular and frequently kidney-shaped. It

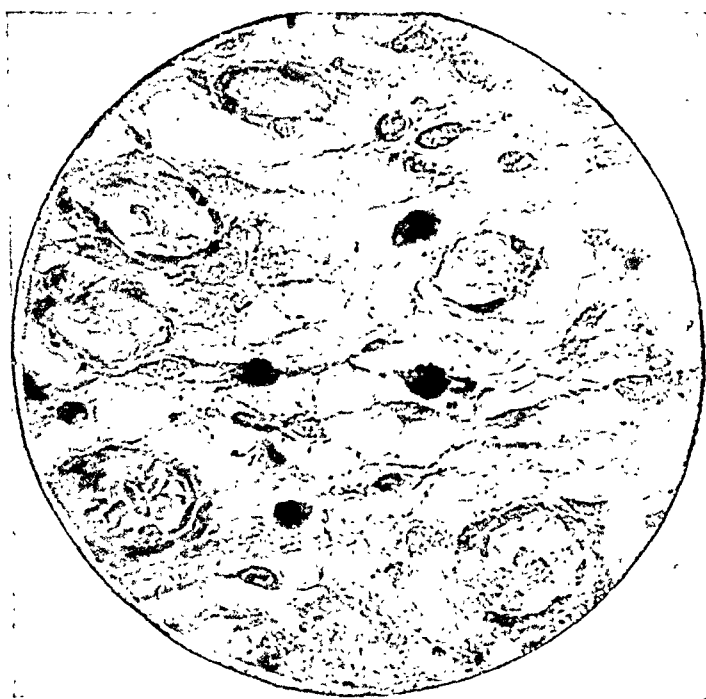


Fig. 1.—Tissue macrophages which have phagocytized particles of dye injected intravenously. From the wall of a rabbit's uterus. (Ocular 10 x; objective, oil immersion,  $\frac{1}{2}$  in.)

stains deeply with the counterstain and is usually situated at the periphery of the cell. The cytoplasm is finely granular, and large and small particles of the dye or other phagocytized material are irregularly distributed throughout. The presence of vacuoles is practically constant.

#### TISSUE MACROPHAGES IN LOCAL INFLAMMATORY PROCESSES

From the first the attention of investigators has been directed to the part played by the macrophages of the connective tissues during inflammation, and numerous papers have appeared on the subject. From 1902 to 1905 Maximov<sup>13, 14</sup> published his exhaustive investiga-

tions clearly demonstrating their rôle in inflammatory reactions and the process of healing. He showed that if a local irritation is set up, there is very soon a response in which three types of cells take part, the fibroblasts, the polymorphonuclear leucocytes which have emigrated from the vessels, and the macrophages or polyblasts. The polyblasts at first occur only in small numbers and later increase tremendously. They also hypertrophy and become markedly phagocytic so that in the final processes they share actively in resorption and may be called "pus phagocytes." They persist for a long time in the tissues and are seen in recent granulation tissue, in the formation of which they share with the fibroblasts. These findings have since been corroborated by several other workers, and notably by Kiyono<sup>21</sup> who discussed the subject in his extensive monograph published in 1914.

In order to study the changes that may be set up by an irritant in the uterus of a rabbit, a series of 12 animals received applications of 20 per cent silver nitrate as previously described. These animals were also given intravenous injections of trypan blue or lithium carmine and were killed at different intervals, so that specimens were available representing the changes that occurred in twenty-four and forty-eight hours, and three, four, six, seven, eleven, and fifteen days, respectively, following the introduction of the cauterizing agent. The sections examined were taken not only at the actual site of the cauterization, but also at various levels of the uterus.

Since the changes incident to a local inflammatory lesion in muscle and connective tissues have been described by many authors, it does not seem necessary to enter into a detailed account here except in so far as they are particularly concerned with the organ in question or with the response of the macrophages. However, examination of sections obtained at the level of the cauterized area show well-marked changes which vary somewhat according to the intensity of the irritant and the length of time that has elapsed following its application. In twenty-four hours the acute reaction is well-developed. There is a necrosis of the epithelium and superficial tissues, and in this necrotic material there is a diffuse deposition of free dye. The surrounding area is edematous, presents extravasations of blood, and there is a tremendous accumulation of polymorphonuclear leucocytes and lymphocytes. A considerable number of macrophages appear at this stage and are found scattered here and there throughout the inflamed region. The tissues of the lateral ligaments and immediately beneath the peritoneal covering of the pars uterina vaginae also share in this cellular activity and show large numbers of leucocytes, while there is a well-defined accumulation of macrophages already present. Sections from the cornua at a high level and from the tubes show a slight subepithelial accumulation of leucocytes while there is a very definite increase in the number of macrophages in the uterine wall.

The reaction of the macrophages is best studied in sections obtained from three to seven days following cauterization. At this stage the local inflammatory changes, edema, extravasation of blood, proliferation of fibroblasts, accumulation of polymorphonuclear leucocytes and lymphocytes, are still very apparent at the actual site of injury. There is also a marked cellular increase in the ligamenta lata and a slight infiltration with leucocytes is noted extending in the propria mucosae of both cornua far above the level of the cauterized area. The most striking feature, however, is the colossal increase in the number and activity of the mononuclear phagocytic cells which have taken up the trypan blue or lithium carmine granules. Not only

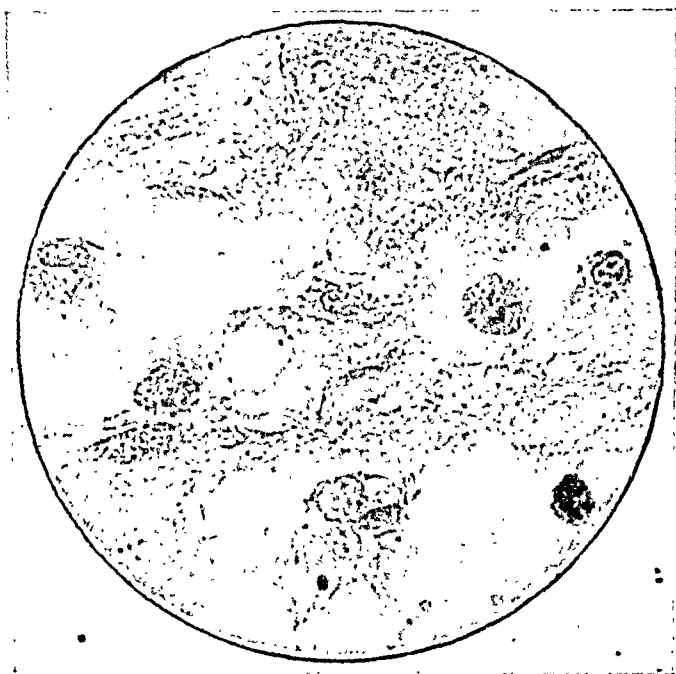


Fig. 2.—Tissue macrophages which have phagocytized particles of dye injected intravenously. From the region of the lateral ligaments. (Ocular 10 x; objective, oil immersion,  $\frac{1}{42}$  in.)

do these cells permeate the inflammatory area, but they are found in tremendous numbers in the whole organ, in the lateral ligaments, in the subperitoneal tissues, in the lymphatic spaces of the musculature, and in the propria mucosae. Sections taken at a high level in the cornua where there is no evidence of an inflammatory reaction beyond a slight round cell infiltration under the epithelium show the macrophages pervading through the depth of the whole wall. The fimbriae of the tubes even partake of this change and show numerous phagocytic cells containing the vital dye.

The actual increase in the number of the macrophages is very striking. While in the normal rabbits only a moderate variation in the size of the individual cells could be seen, there are now large numbers

of cells demonstrated by the vital dye which are of a comparatively small size and others showing marked hypertrophy. There is some controversy as to the significance of the smaller cells, whether they represent young macrophages which have arisen in situ from preexisting mature cells, or leucocytes developing into macrophages. The discussion centers on the mode of origin of the macrophages and opens up such a large field that it cannot be considered in this report. It is evident, however, that the presence of the smaller cells represents the activity associated with an increase in the number of cells. Although Kiyono noted many cells showing mitoses, I have been unable to satisfy myself on this point from the sections available in this series, but several cells with dumb-bell-shaped nuclei suggest that proliferation may occur in the tissues by a process of direct division.

There is also well-defined evidence of an increased phagocytic activity of the macrophages in a marked hypertrophy of the individual cells and a greater number of dye granules that they absorb. In addition to the dye, particles of tissue debris, blood pigment, intact red blood cells, and leucocytes may be seen phagocytized within the macrophages. The "pus phagocytes" are represented by large degenerated macrophages completely filled with engulfed material and are recognizable by a diffuse staining of the cytoplasm.

The specimens obtained from eleven to fifteen days following cauterization show a somewhat different picture. In the cases here studied, the cauterization had been carried out to a milder degree, and at this stage there has been a more or less complete regeneration of the surface epithelium of the pars uterina vaginae. There is still a moderate infiltration with small round cells extending into the cornua, and in one case numerous small abscesses are seen in the propria mucosae. There is now, moreover, a considerable diminution in the numbers of macrophages present although they are still far in excess of those found normally, and they extend throughout the whole thickness of the uterine wall. There is also no longer the appearance of marked activity seen in the previous sections. The smaller macrophages are few in number and the individual cells as a rule are not overlaid with dye and phagocytized material. There are, however, still a considerable number of hypertrophied cells and degenerating "pus phagocytes."

In addition to the series of animals in whom a cauterization with silver nitrate was performed, another six rabbits received a traumatic injury by perforation of the wall of the pars uterina vaginae with a blunt instrument. The reaction observed in this instance was identical with that reported above except that it was much more marked in the lateral ligaments and in the subperitoneal tissues.

Thus in experimental inflammatory lesions of the rabbit's vagina and uterus, the tissue macrophages take a very important part. This

is shown by a tremendous increase in actual numbers with a widespread distribution throughout the whole uterus, the fallopian tubes, and the surrounding tissues of the lateral ligaments, while there is evidence of an increase in the phagocytic activity of the individual cells.

#### MACROPHAGES IN THE UTERI OF PREGNANT RABBITS

In the various extensive studies on intravital staining that have been published, there are only a few isolated observations regarding the macrophages of the uterus under normal conditions or during pregnancy. Goldmann<sup>17</sup> studied a number of mice, pregnant and non-pregnant, and noted that gross staining of the uterus increased in intensity as pregnancy progressed. Both he and Kiyono,<sup>21</sup> however, were mainly concerned with the reaction to the dye in the region of the placenta and fetus. Schlecht<sup>30</sup> stated that normally cells taking up the dye are only to be found here and there in the uterine wall, but that the staining is much more striking in the gravid condition. In 1911, Ancel and Bouin<sup>31, 32</sup> described certain cells which appear in the muscle tissue of the rabbit's uterus at about the sixteenth day of gestation and gradually increase in number until parturition. They felt that these cells represent a glandular structure, a "myometrial gland," which exerts a controlling influence on the development of the mammary gland during the latter half of pregnancy. This problem was taken up by Mercier,<sup>33, 34</sup> who demonstrated that these cells engulfed particles of dye, and hence, should be considered as a type of phagocyte and not as elements of a gland.

The incidence of macrophages in the pregnant uterus was studied in a series of 7 rabbits representing various stages of gestation. In one animal the injection of dye produced death of the embryos and two dead fetus 4 cm. long were expelled on the third day of staining. In no case did the fetus have any trace of the dye injected into the mothers, but the amniotic fluid showed a bluish discoloration. Two rabbits also received injections of trypan blue and were killed five days and one month postpartum, respectively, in order to study the changes during the puerperium.

The findings in these cases were constant and showed that from the first there is a tremendous increase in the number of macrophages in both the vagina and uterus. This is noted even in specimens only a few days old but owing to the colossal numbers that are present and the fact that there is no satisfactory way of actually counting the cells, it is difficult to state whether they continue to increase throughout the whole of pregnancy. They are especially noted in the cornua at the level of the gestation sacs but the whole organ and the fallopian tubes take part in the process. The cells are found in all the layers

of the uterus as previously described, and they show the marked increase in phagocytic activity that was noted in the case of inflammation.

The sections from the animals during the puerperium show a persistence of large numbers of macrophages in the walls of the uterus and vagina. Even one month postpartum they are to be seen far in excess of those found under normal conditions. This finding is in keeping with the work of Teacher<sup>35</sup> who pointed out that phagocytic cells are to be seen in the walls of the uterus in the human for a long period of time after delivery.

#### MACROPHAGES IN HUMAN STUDIES

Although it has been shown that reticulo-endothelial cells are present in all vertebrates down to the cyclostomes (Jaffé<sup>24</sup>), there are certain peculiarities in different species and the question now arises as to whether the above findings are applicable to humans.

Since Ribbert<sup>15</sup> showed that the cells of the body which take up intravital stains are also able to absorb other substances such as iron, lipoids, etc., injected into the circulation, a few attempts have been made to study macrophages in this way in human beings. In 1923, Richter<sup>36</sup> described the findings in the pelvic organs of six women, varying from forty-nine to sixty-six years of age, in whom a concentrated solution of colloidal iron oxide (*ferrum oxydatum saccharatum*) had been injected intravenously shortly before death. He studied sections of the uterus, parametria, ovaries, cervix, and vagina, and noted that cells which had taken up the iron were to be seen only in the parametrium with the exception of one case. In this instance he also found a very slight deposition of iron in the other tissues examined. Although this patient received 300 c.c. of the solution, whereas none of the others were given more than 100 c.c., he did not feel that this influenced the findings, and concluded that the number of reticulo-endothelial cells in the female genital organs are in an insufficient number to be of practical importance. Recently, however, Motta<sup>37</sup> described certain phagocytic cells containing hemosiderin, fatty pigments, and lipoids, which consistently occur in the connective tissues of the uterus and especially in the myometrium and subserous tissues. He considers these cells as identical with Aschoff's reticulo-endothelial cells and found that they greatly increased in number at the time of the menstrual period.

The presence of macrophages in various chronic inflammatory conditions and in a number of specific infections has been dealt with at length by numerous observers. Their occurrence in pelvic infections seems to have attracted little attention, although Mallory<sup>28</sup> states that they are sometimes present in cases of salpingitis. The study of a



number of specimens obtained from the Stanford Gynecological service shows that their implication in the human is a very variable feature. Sections from several cases of chronic salpingitis were carefully studied and no macrophages could be successfully demonstrated. In other instances, however, and especially where there were hemorrhagic lesions in an inflammatory mass made up of tube and ovary, they could be made out in considerable numbers. The examination of sections from the base of the broad ligaments showed that isolated macrophages were present in almost every case, but no great increase was noted here in the few specimens of chronic salpingitis examined.

The existence of a marked cellular reaction in which the macrophages take an important part has been definitely demonstrated in the pregnant uterus. In 1924, Hornung<sup>39</sup> studied a large series of uteri in various stages of pregnancy and during the puerperium, and found a cellular reaction extending throughout the connective tissue elements of the uterine wall. This histiogenic reaction, in which phagocytic cells are found in large numbers, occurs in all normal pregnant uteri and is more marked as term approaches, while it is particularly intense in the presence of infection. These observations were confirmed by Hofbauer,<sup>40</sup> who in addition studied sections from the base of the broad ligaments and was able to show that the parametria are extensively involved in this cellular reaction. Motta also noted the increase of phagocytic cells in the uterus during pregnancy.

In his study of the involution of the uterus postpartum, Teacher<sup>35</sup> points out the constant occurrence of phagocytic cells and their importance as evidence of recent pregnancy. He found fat-laden phagocytes in the connective tissue planes between the muscle which can be recognized up to about forty days postpartum. The examination of the placental site fourteen days postpartum also showed many groups of phagocytes laden with blood pigment, and he observed that these cells remain a striking and characteristic feature of the endometrium for many weeks thereafter.

Although only a few reports on the mononuclear phagocytic cells of the human uterus have thus as yet been published, there is sufficient evidence to conclude that macrophages do occur, although not to the same degree that they do in the rabbit. They are present normally in small numbers; they are tremendously increased during pregnancy and the puerperium, and in cases of puerperal infection. Their exact rôle in infections of the nonpregnant organ is as yet not fully determined, but they do occur in large numbers in some instances.

#### DISCUSSION

In evaluating the macrophages which have been described in the uterus, there are a few general considerations which must not be lost sight of. In the first place, we are dealing with cells the exact origin

of which is still a matter of controversy, some observers claiming that they arise from lymphatic or vascular endothelium, others from the fibroblasts of the connective tissues, others that they are white blood cells which have undergone a metamorphosis, etc. There is also the possibility that under the term "macrophage" are included two definite varieties of cells, the clasmatoocytes and monocytes of Sabin and her collaborators, a contention which is ably supported by experimental evidence. Then it must be remembered that these cells of the connective tissues are intimately associated with macrophages in the circulating blood and as special types in certain parenchymatous organs. Aschoff has grouped these various cellular elements under the general term of reticulo-endothelial system, and in this light we may have to do not with a simple local process in the uterus, but with a complicated phenomenon involving essentially the whole body.

The action of phagocytosis is one which may be assumed by a great many cells of the body under the stress of a particular irritation, but with the macrophages it is a selective characteristic. In the region of local inflammatory changes they act as scavengers in removing tissue debris, dead leucocytes, red blood cells, etc. They may form a part of the exudate in inflammations of the peritoneum or pleura. They take an active share in the healing of bone wounds (Macklin<sup>41</sup>), and also possibly in the formation of granulation tissue, since it is claimed they may give rise to fibroblasts. This was originally contended by Maximov,<sup>13, 14</sup> and Carrel and Ebeling,<sup>42</sup> Fischer,<sup>43</sup> and Foot<sup>26</sup> have since demonstrated this transformation in tissue cultures.

When macrophages come in contact with bacteria, they absorb them by phagocytosis, and consequently they play a very important part in the defense of the body against invasion by microorganisms. They are indeed of prime importance in the lesions of several specific infections (sporotrichosis, the lepra nodule, etc.), but even in the nonspecific infections, they may become involved to a variable degree. Wysokowitsch<sup>44</sup> as early as 1886 showed that bacteria injected intravenously were rapidly removed from the circulation by the fixed cells of the spleen and various organs. Since then a great deal of experimental evidence has accumulated. Siegmund<sup>45</sup> published various observations on the reaction of the reticulo-endothelial system to chronic streptococcus infections. Jacob<sup>46</sup> observed its involvement in experimental staphylococcus and streptococcus infections, and Domagk<sup>47</sup> found that dead and living bacteria injected into mice were phagocytosed and digested by the endothelial cells of the spleen, liver, and lungs. There is similarly definite evidence that the macrophages are of paramount importance in local and general immunity reactions. Gay,<sup>48</sup> and Gay and Morrison<sup>49</sup> have considered this subject and maintain that "tissue macrophages are in large part, if not entirely, responsible for the natural resistance of rabbits to experimental strep-

tococcus infections." This is further borne out by the work of Nakahara<sup>50</sup> who found that by producing a marked macrophage reaction in the peritoneal cavity of mice, they would survive multiples of the fatal doses of streptococci and pneumococci. Both Hornung<sup>39</sup> and Hofbauer<sup>40</sup> point out that as a result of the increase in macrophages during pregnancy, the uterus is in a condition of increased readiness to act against any possible infection.

The increase of phagocytic cells in the uterus during pregnancy offers several interesting problems. Since we have here tremendous changes in local tissues due to rapid growth and some destruction of uterine tissue by trophoblastic cells, the first assumption is that the macrophages are called upon to dispose of any *débris* resulting from the local processes. Hofbauer,<sup>40</sup> however, does not believe that the specific stimulant in the parametrium is the result of the breakdown of fetal or chorionic tissue, and suggests that it may be due to the action of the same hormones that produce the well-known changes in the various organs of the pregnant woman. This leads us to consider the reticulo-endothelial system as a unity, and there is reason to believe that during pregnancy it exhibits a heightened activity. Benda<sup>51</sup> found an increased permeability of the meninges during the second half of gestation and believes that there occurs an alteration involving the whole reticulo-endothelial system. Lundwall<sup>52</sup> also found an increased activity in that there was a more rapid storage of congo red by the reticulo-endothelial cells in pregnant than in nonpregnant women. Although these methods of investigating the function of the reticulo-endothelial system are open to criticism, there is yet the possibility that the many macrophages which appear in the pregnant uterus are evidences of a general reaction and not solely a local tissue change.

In spite of the tremendous amount of work that has been expended on the various phases of this problem, there are still many points that remain obscure and the subject should prove of great interest to obstetricians and gynecologists. The exact rôle of the reticulo-endothelial system during pregnancy offers a wide field for research, not only in connection with normal gestation and puerperal infection, but the possibility of its function in the elimination of toxic substances in eclampsia and other pregnancy toxemias. The occurrence and function of the local tissue macrophages in the human pelvic organs under various physiologic and pathologic conditions and the factors that govern their appearance in various infections are features which demand much further investigation. And finally, there remains the possibility of a therapeutic stimulation of these cells which would add a powerful agent to our armamentarium in the struggle against disease.

# SUMMARY

In this study three series of rabbits received intravenous injections of an intravital dye to determine the occurrence of macrophages in the connective tissues of the uterus under normal conditions, in aseptic inflammation, and during pregnancy.

Normally macrophages are present in the tissues of the rabbit's uterus and vagina in comparatively small numbers.

In aseptic inflammation they occur at the site of the lesion in the same manner that has been described for similar processes in other connective tissues of the body. There is in addition, however, a widespread response in the cornua, the fallopian tubes, and the lateral ligaments, where countless numbers of macrophages showing increased activity are to be seen.

There is a similar tremendous increase in the number of these cells and an increase in their activity during gestation. This persists for a long time during the puerperium.

The function of the macrophages is to act as scavengers in removing tissue débris and to assist in the healing of tissue injury. They are of great importance in local tissue immunity. Their appearance, especially during the gestation period, may possibly represent a general reaction of the whole reticulo-endothelial system rather than merely a local change.

The occurrence of macrophages in the human uterus under normal conditions is not fully determined, and their implication in inflammatory lesions is variable. Their presence in large numbers during pregnancy has been clearly established.

My thanks are due to Mr. Pierre Lassègues for the microphotographs in this article and for his invaluable technical assistance, and also to Mr. A. Behnke for technical assistance.

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**De Snoo: The Time Factor in Obstetrics.** Nederlandsch Tijdschrift voor Verloskunde en Gynækologie, 1924, xxix, 265.

In a masterly review, De Snoo reviews the factor of time in obstetrics, using as a basis for his exhaustive study the 1561 women delivered in the Royal Midwife School at Rotterdam from 1914 to 1919. In general, he speaks of the tendency in modern times to shorten labor by various methods which has become especially prevalent in America. In this connection he concludes: "The duration of natural processes cannot be deliberately shortened or interrupted without danger, so long as they remain within certain empirically determined normal limits." Even in necessary procedures, such as forceps application, external or internal version, De Snoo counsels deliberation rather than haste. In cases of urgency, such as prolapse of the cord or bleeding, greater damage may be done by undue haste. The neglect of proper aseptic precautions may do more harm than the original indication for intervention since a child may live from fifteen to twenty-five minutes even after complete compression of the cord. Likewise, many an apparently dead child will recover if calmly and gently handled but would succumb as the result of hasty and rough treatment. The uterus also should be given ample time to expel the placenta if we wish to avoid unnecessary bleeding. Even in childbed fever the main object is to keep the patient alive so as to gain time for the natural processes of repair.

In particular, De Snoo analyzes the time factors as applied to gestation, parturition, etc. The whole subject is minutely analyzed and illustrated by numerous tables.

R. E. WOBUS.

# THE TECHNIC OF INTRAUTERINE LIPIODOL INJECTIONS IN GYNECOLOGIC DIAGNOSIS\*

BY JOHN C. HIRST, 2ND, M.D., PHILADELPHIA, PA.

THE use of lipiodol in this manner has passed well beyond the experimental stage, and it is generally known that the following information may be readily obtained: the location of tubal obstructions, which permits the diagnosis of operability of tubal sterility; hydrosalpinx; uterine myomas, and submucous growths; pelvic diagnosis in very obese women, etc., and possibly, the diagnosis of early pregnancy, a doubtful procedure.

Therefore, we desire not to present a number of illustrations of the above conditions, but rather to briefly describe a safe method of

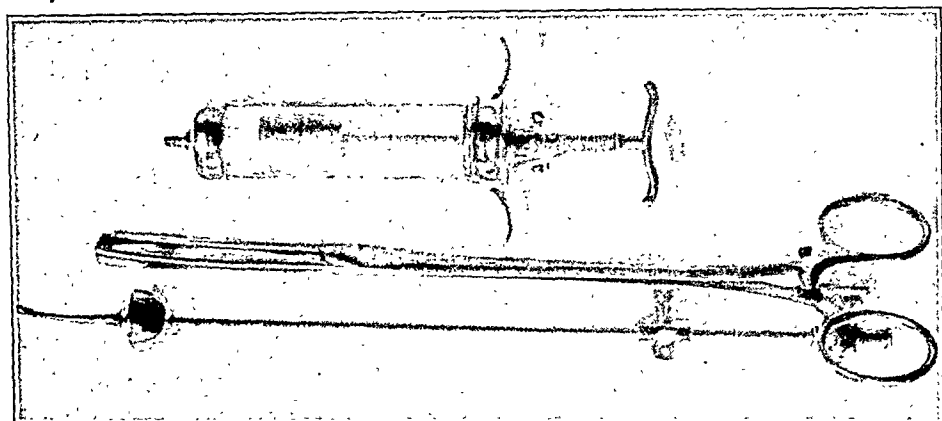


Fig. 1.—Special combined syringe, cannula and tenaculum, recommended by Forestier.

using iodized oil, and to pick out a few unusual conditions in its use. The best readily available description of the properties of lipiodol is found in a warning of the dangers incident to injections into the tracheobronchial system, by Archibald and Brown<sup>1</sup>; and the most satisfactory illustration of method, diagnosis and fate of lipiodol in the uterus, tubes and peritoneal cavity may be found in the full report of McCready and Ryan.<sup>2</sup>

The literature on the subject shows a multiplicity of method and little attempt to carefully weigh disadvantages, either actual or potential. We, therefore, present a technic that we believe to be safe and efficient, and call attention to certain undesirable possibilities. More than a year ago, thanks to the courtesy of Professor Barton C. Hirst, I had the privilege of presenting Dr. Jacques Forestier, the originator of the lipiodol technic to the Senior Class in Obstetrics of the Uni-

\*Read at a meeting of the Obstetrical Society of Philadelphia, May 5, 1927.

versity of Pennsylvania Medical School, where he described his method, including particularly a special syringe and cannula (Fig. 1). Following this we used the test on twenty-one occasions, as follows:

1. *Rubin Test*: repeated at least once. The majority of cases followed by lipiodol injection had nonpatent tubes according to the Rubin test. No belladonna was administered before either procedure.

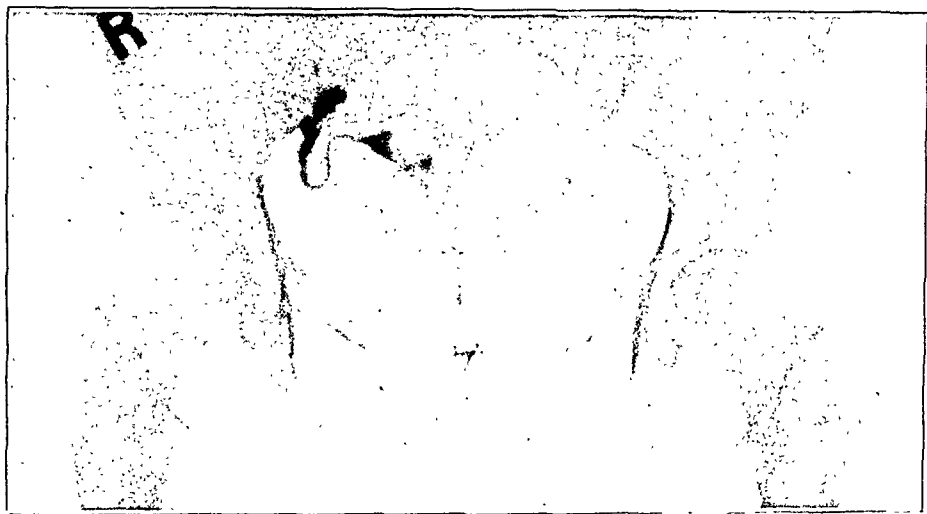


Fig. 2.—Rubin test, 160 to 180 mm. Hg. Previous operation, left ruptured ectopic, with left salpingectomy. Right parovarian cystectomy, with resection of right tube. Lipiodol (seven months after operation) shows patency of the resected right tube.



Fig. 3.—January 14, 1924, sterile three years, Rubin test, closed tubes at 200 mm. Hg., followed by operation, resection of right tube and Estes operation on left side. Delivered August, 1926. February 8, 1927, Rubin test 140 to 160 mm. Hg., and lipiodol shows right tube patent.

2. Most lipiodol injections were in hospital cases, and for the future all will be.

Our technic is as follows: Simple enema, shaving and scrubbing. Painting of vulva, vagina and cervix with acetone alcohol-mercuro-

chrome. Exposure of cervix with weighted speculum; application of the cannula, removal of speculum, and injection of warm lipiodol slowly under the fluoroscope, holding the cervix uteri in such a position as to allow the corpus uteri to assume a position parallel to the x-ray plate. Stereoscopic exposure in the dorsal recumbent posture is made after intermittent injection, averaging about 6 c.c. or enough to reach the peritoneal cavity or point of obstruction. After removal of the cannula, the uterine position is checked to favor drainage, the patient put to bed, and a second exposure made in twenty-four hours since the oil occasionally drifts through a supposed complete obstruction.

A short summary of results proves interesting:

1. Every one of our patients stated that the lipiodol injection was less painful than the Rubin test.

2. Several of the cases were subsequently operated on and the diagnosis confirmed. The accuracy of the test depends upon the special cannula, fluoroscopic control and repetition of the stereograms, in twenty-four hours in doubtful cases.

3. No patient showed any demonstrable reaction, with one exception.

4. One accident was met with in a woman who urgently requested operation twenty-four hours after the lipiodol test. Distal salpingostomy, and suspension was performed most satisfactorily, but streptococcic peritonitis caused the death of the patient. This operation followed a streptococcic case, the strain of organism being identical in each instance. Nevertheless, we will regard a lapse of time essential before operation in the future.

5. No patient has conceived wherein the tubes were shown to be closed by x-ray diagnosis.

6. Of four cases showing one or more open tubes, none has conceived. We do not feel, however, that the action of lipiodol could prejudice future conception.

7. Diagnostic value in tubal sterility rests in the ability to determine whether the tubes are occluded at the inner or outer end. In the former instance, no operative correction is available with more than a remote chance of success; whereas in the latter cases, distal salpingostomy or tubal resection may offer more hope, other factors being favorable.

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(For discussion, see page 879.)



# THE CAPILLARY PRESSURE IN THE TOXEMIAS OF PREGNANCY

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MANY studies have been made of the behavior of the capillaries during pregnancy in the hope of finding an aid in maternal and fetal prognosis. Most of these investigations have been limited to the study of the capillary morphology.

The observations here recorded have been made on the capillaries of the fingers as they approach the cuticle. The skin is covered with mineral oil, strongly illuminated and examined under low power magnification. The morphology of the capillary can best be studied under the following classification:

1. Number of capillaries; size of interspaces.
2. Form; most commonly hairpin shape.
3. Caliber, with comparison of the arterial and venous limbs of the capillary.
4. Streaming rate of flow; also its rhythm. When the blood column shows many areas alternately filled with or empty of blood, it is usually described as "beaded."

In the eclamptic and nephritic toxemias of pregnancy, Neverman,<sup>1</sup> Hinselman,<sup>2</sup> Linzenmeier,<sup>3</sup> and Niekau,<sup>4</sup> describe what is essentially a capillary stasis, varying in degree with the severity of the toxemia. This is manifested by a change in the caliber of the arterial limb which may vary from a moderate narrowing to a complete closure. The capillary blood stream will be similarly affected. In the milder cases this will only be slowed; more usually it is beaded. In the most severe cases the stasis is complete with frequent reversal of flow. The resultant anoxemia is made apparent by the cyanotic appearance of the capillary blood. The form of the capillaries is variously described by different authors. Many describe marked tortuosities, figure-of-eight shape and with anastomoses, which clear up several months postpartum. These local manifestations are thought to be part of a generalized, capillary, toxic, angiospastic disturbance; the result of a toxic stimulation of the capillary nervous supply or musculature.

These observers also believe that the local capillary disturbances precede the clinically apparent lesions in the liver, kidney, brain, and other organs. This observation may serve as a guide to the clinician in terminating a toxic pregnancy before the more dangerous stage of convulsions and hemorrhage is reached.

Heineman<sup>5</sup> states that when the capillaries of the gravid show

marked spastic changes, such as spasmodic flow or reversal of the blood stream, convulsions can be predicted. In cases of hypertension with a smooth capillary flow no convulsions will take place, and the high blood pressure is considered of the nephritic type.

Our own observations on the capillaries of a series of gravid women are recorded in Tables II and III. Clinically, these cases presented the picture of a hypertension without renal insufficiency or convulsions, a group named the hypertensive toxemias by Corwin and Herick.<sup>6</sup> In some of these cases as the toxemia increased the picture changed to that of the convulsive or nephritic toxemia.

It will be noted that under morphology all the above enumerated abnormalities of the capillary have been noted. However, they have been far from constant. They were not limited to the toxic cases nor were they most marked in the severe cases. Krogh states that the variations in the healthy are very great, especially in shape and character of flow. The variations in caliber were great in this series. Though marked spastic changes were found, still Case 6 showing these in the extreme, was clinically nontoxic except for the hypertension. Her capillaries showed complete stopping of the blood stream with reversal and marked beading. In this case the patient's highly neurotic state probably overstimulated her vasomotor system.

Another type of capillary spasticity was observed in Case 22. It was a slow wave-like occlusion of the capillary lumen. The arterial limb was gradually obliterated and then the venous limb would disappear as the contraction reached the bend. It was apparent that this was a wave-like contraction in contrast to the usual segmented type. This case was clinically one of a marked arteriosclerosis with tortuous retinal vessels almost threadlike in diameter, yet with shape, caliber and streaming of the majority of the capillaries not differing from the average.

Niekau and Weis describe a similar picture in their studies on patients having a multiplicity of complaints without any organic disease and clinically diagnosed vasoneuroses. It is of interest to note here, as others have observed, that during active labor simultaneously with each contraction of the uterus the capillaries at the nail base contract and at times disappear from view.

Aside from the capillaries the interspaces may show abnormalities of interest. Case 8, a severe eclampsia, irrational, with convulsions, edema, jaundice and retinal hemorrhage was of interest in this respect. Many irregularly shaped deposits of bile pigment were seen. Surrounding several of the capillaries like a halo, blood was present, apparently having oozed through the injured endothelium. The streaming of the blood through the capillary was still present though slow. All these abnormalities cleared up with the recovery of the patient.

TABLE I. NONTOXIC CASES

CASE NO.	DATE	CAPILLARY MORPHOLOGY	CAPILLARY PRESSURE								B. P.	KIDNEY FUNCTION	PROGRESS OF PREGNANCY	CHILD
			10	12	15	15	10	12	12	8				
17	12/22	Long flow rapid	10	12	15	15	10	12	12		118/78	Good	Normal	Living
18	12/22	Long stream beaded	10	10	8	14	6	8	8		104/62	Good	Normal	Living
23	8/15	Narrow flow very rapid and beaded	14	18	16	13	20	10	10		130/70	Good	Normal	Living

TABLE II. HYPERTENSIVE TOXEMIA CASES WITH LOW CAPILLARY PRESSURE

CASE NO.	DATE	CAPILLARY MORPHOLOGY	CAPILLARY PRESSURE								B. P.	KIDNEY FUNCTION	PROGRESS OF PREGNANCY	CHILD	REMARKS
			25	20	20	22	24	20	20	20					
1	10/15	Elongated flow sluggish, caliber normal	25	20	20	22	24	20	20	20	125/90	Unimpaired	Delivery full term	Living	
5	10/2	Loops full, dilated, many convoluted types	18	15	15	14	18	20	20	20	120/80	Unimpaired	Delivery full term	Living	
10	10/19	Very tortuous and bizarre forms	15	14	20	15	18	20	15	16	140/85	Unimpaired	Edema of face and hands	Living	
16	1/24	Small, beaded flow, slow	15	15	20	15	12	12	170/110	Unimpaired	150/90	Unimpaired	Clinically improved delivery precipitate	Living	Excitement increases B. P. and C. P.
21	10/18	Flow smooth and slow	25	12	8	10	15	15	140/110	Unimpaired	140/110	Unimpaired	Delivery full term	Living	
22	10/18	Very rapid flow — no beading	8	10	10	15	15	15	140/100	Unimpaired	140/100	Unimpaired	Extreme arterio-sclerosis, chronic	Living	
		Narrow arterial limb, Venous limb much wider in some—spasms of arterial alternately emptying capillary	12	5									Normal delivery	Living	
24	12/16	Venous limb wider, flow slow	15	12	15	10	12	12	119/60	Poor	119/60	Poor	Hypertension responded to treatment	Living	
26	9/5	Very long, flow normal	10	12	10	8	10	10	105/60	Unimpaired	105/60	Unimpaired	Delivery full term	Intrauterine death at 7 months	Former pregnancy complicated by hypertension with fetal death

The capillaries in health and disease are undoubtedly sites of great metabolic activity. The interchange between the tissues and the blood plasma of fluids, crystalloids and colloids is brought about by the capillaries. Changes in the composition of the blood take place in the normal and pathologic gravida. R. V. Wiener<sup>7</sup> has shown low total chlorides in the normal and contrasting high total chlorides in the toxemias of pregnancy. The osmotic pressure of the blood, which depends upon the amount of crystalloids and to some lesser extent upon the colloids dissolved in the blood plasma, will, therefore, parallel Dr. Wiener's findings. Scipiades and Farkas<sup>8</sup> have shown this to be true, finding a low osmotic pressure in normal pregnancy. The osmotic pressure of the blood according to Starling's theory is counter-balanced by the capillary blood pressure. The osmotic pressure is that attraction that the dissolved crystalloids and colloids have for the fluids in the tissues surrounding the capillary endothelium. The capillary blood pressure can permit or prevent this interchange of fluid. If the capillary blood pressure is increased then the osmotic attraction is overcome and a filtration in the opposite direction will take place with loss of fluid from the blood. This has been confirmed by Krogh<sup>9</sup> and Landis,<sup>10</sup> and explains the mechanism of fluid and crystalloid interchange. In order to explain the passage of colloids, Krogh claims that the endothelial cells must separate to permit the colloidal particles to pass through the cement substance. Landis has, however, shown that this is not necessary. That without any capillary dilatation, but with capillary endothelium injured and the capillary pressure increased over the osmotic pressure, a filtration seven times as rapid will result than with an uninjured endothelium. Hence, with an infectious or toxic injury to the endothelium the passage of the plasma and its contents does not depend upon capillary dilatation but simply upon an increased capillary pressure.

We have studied the capillary blood pressure in a series of women whose pregnancy was complicated by a constant hypertension. These pressures were read with the capillary tonometer of Danzer and Hooker under constant conditions. The patients were in bed, and the hand and arm at body temperature and held at the level of the heart.

Table I lists several typical normal gravida whose capillary morphology and pressure were normal. These were delivered of living children, and the course of pregnancy was normal in all cases.

Table II lists all cases of hypertension with low capillary pressure readings during pregnancy. In this series the expectant mothers responded readily to conservative routine treatment. There was but one fetal death. This mother had no obvious toxic symptoms, but because of a fetal death following hypertension in a previous pregnancy, the patient was considered an example of toxemia.

TABLE III. HYPERTENSIVE TOXEMIA CASES WITH HIGH CAPILLARY PRESSURE

CASE NO.	DATE	CAPILLARY MORPHOLOGY	CAPILLARY PRESSURE	B. P.	KIDNEY FUNCTION	PROGRESS OF PREGNANCY	CHILD	REMARKS
3	10/ 2	Capillaries narrow, flow is slow, no tortuosity	35 32 30 25 30 35 32	150/110	Bad	Hypertension increased in spite of treatment 10/4 labor induced in eighth month Condition good	Living	Had hypertension before becoming pregnant
4	10/ 9	Capillaries full, flow rapid	25 20 15 20 20 22 25	130/ 90		Normal	Living	
6	10/15	Loops long and narrow, beading present	25 32 30 25 20 32 30	130/ 80	Urine—gran. casts		Living	
	10/ 1	Form normal, flow convulsive, stopping suddenly, reversing, shooting ahead nonrhythmically	40 35 30 25 25 50 60 55 48 40	165/110	Good	Readings made during a crying spell Delivery normal	Living	
20	5d p.p. 6/14	Flow smooth no beading Venous limb four times the arterial limb	20 22 18 20 18 20	195/160	Good	Blood pressure continued high; labor induced Convulsions a week before	Living	
7	9/10	Caliber narrow, rapid, spasmodic cessation of flow	32 35 25 40 40 35 35 35 40	150/100	Alb. 75% (urine)	Clinically improved 9/14 No fetal heart heard	Died	
	9/13	Capillaries fine, flow rapid	25 25 27 20 28 28 25 20	155/110		Spontaneous delivery	Macerated	
8	9/15	Wider, no spasm	18 20 30 24 24 20 14 18	140/ 90		Irrational, edema marked		Wassermann 4-plus
	7/14	Narrow, tortuous, evident attempt at elongation	40 40 32 28 38 28 28 35	212/140	Bad	7/22 Labor induced	Living	
	8/ 6	Less tortuous	28 26 28 30 26 28 28 26	200/130				

TABLE III—Cont'd

CASE NO.	DATE	CAPILLARY MORPHOLOGY	CAPILLARY PRESSURE					B. P.	KIDNEY FUNCTION	PROGRESS OF PREGNANCY	CHILD	REMARKS
15	12/16	Venous limb dilated and tortuous, flow rapid	28	30	30	28	30	160/90	Poor	Improved under treatment		
	12/22	Same	25	28	28	30	25	30	140/85	1/12 Spontaneous delivery—7½ mo.	Dead	
	1/24	Caliber normal, slow flow	20	25	20	15	20	15	130/80			
11	10/30	Narrow limbs, equal flow	12	48	38	40	32	48	140/90	Edema very marked		
		rapid, spasmodic	46	42	42					Gr a n. casts blood chem. normal		
	11/1	Same	50	48	42	38	38	140/90		Edema less	Dead	
	11/10		25	30	25	30	22	25	120/80	11/15 labor induced, gas and oxygen anes.		
	11/17	Flow rapid	32	30	25	30	30	35	130/80			
	11/27	Same	25	20	25	20	25	25	130/80			
18	6/16	Arterial limb narrower than venous	32	30	30	24	24	32	150/110	Response to treatment good		
	6/20	Flow rapid	32	32	24	26	20	32	170/120	Delivery normal	Living	
19	10/18	Narrow elongated, flow normal	32	32	30	35	35	32	180/110	Blood pressure continued upward in spite of treatment	Dead	
			35	30								
24	2/5	Dilated, flow beady	25	22	18	25	30	30	130/70	Labor induced	Dead	Past history of nephritis

Table III lists those cases showing a high capillary pressure reading during pregnancy. The course of pregnancy was stormy and the response to treatment was poor in 70 per cent of the mothers with the resultant therapeutic induction of labor. Fetal death resulted in 50 per cent of the cases.

Consideration of the causes of increased capillary pressure in some of the hypertensive toxemias of pregnancy must wait for a greater knowledge of the disease and the capillary. It has been shown that concomitant with a high capillary pressure there is an increase in osmotic pressure, and a concentration of some of the chemical constituents of the blood. It remains to be decided whether the capillary pressure is increased as a protective mechanism against the increase in osmotic pressure or primarily as the result of a constitutional response to the burden of pregnancy. Without doubt the presence of a high capillary pressure in pregnancy is indicative of a grave disturbance, and of danger to mother and fetus.

In accepting a high capillary pressure reading, it is best to avoid including those patients who are mentally excited. Cases 6 and 10 illustrated the response that the capillaries make to excitement. Their caliber diminished, streaming became impeded and the pressure rose to very high figures with prompt fall upon return of the subjects to normal composure. The brachial blood pressure in these instances followed the capillary pressure.

In Case 11, it is of interest to note that with a high capillary there was a diastolic pressure of only 90 mm. This patient after an induction of labor under nitrous oxide showed an increase in capillary pressure of 10 mm. without a corresponding increase in brachial pressure.

The capillary pressure could not be deduced from the brachial blood pressure in any case in this series.

It will be noted in Table II that Case 20 was included in spite of a normal capillary reading of 18 to 20 mm. The morphology of the capillaries in this case presented a picture of acrocyanosis—elongated, dilated capillaries. As the average pressure for this type of capillary is normally 0 to 5 mm., I considered 18 to 20 mm. a high reading.

The effect of intravenous injections of 25 c.c. of 10 per cent  $MgSO_4$  has been studied in several cases. All showed a prompt reduction in capillary pressure simultaneously with the brachial pressure, followed by a gradual return to the original reading. The response of Case 18 is typical and recorded in Table IV.

TABLE IV

	B. P.	C. P.
Before injection	150/110	28
2 min. after injection	110/70	15
12 min. after injection	140/100	20
30 min. after injection	140/100	25

## SUMMARY AND CONCLUSIONS

1. The morphology in a series of cases at the Sloane Maternity of the capillaries in the hypertensive toxemias has been studied and no consistently typical picture has been observed.

2. The hypertensive toxemias of pregnancy with a low capillary blood pressure showed the most favorable maternal and fetal prognosis.

3. The presence of a high capillary pressure in the hypertensive toxemias of pregnancy is a factor making for an unfavorable prognosis for the mother and fetus.

4. The response of the capillary pressure to the intravenous injection of  $MgSO_4$  has been found to parallel that of the brachial pressure excepting that the return to the original reading was less prompt.

## REFERENCES

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Kaboth, G.: Studies in the Origin of Pregnancy Edema. Archiv fuer Gynaekologie, 1925, cxxvii, 170.

The author finds that there is in pregnancy, and especially when eclampsia or nephrosis is present, a change in the ratio between serum albumin and serum globulin. The normal ratio between these two substances is 1.5—2 and in the presence of edema is 0.81. The specific osmotic pressure of the colloids, as measured by the osmometer, which is described in detail, is lowered parallel to these changes. This lowering of the hydration energy results in the pregnancy edema, since the blood colloids are known to regulate fluid exchange between the blood stream and the tissues. There is also an increased permeability in the capillaries and venules which is partially due to the changes in the size of the capillaries and the capillary stream, and partially to increased "filtration pressure" in the smallest venules.

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## ACID-BASE BALANCE IN PREGNANCY

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SO-CALLED "normal" anatomic and physiologic conditions are greatly altered in pregnancy. In the absence of complications, however, all the changes which take place are to be considered physiologic. Disease produces many changes which have been the object of numerous interesting studies. Pregnancy is accompanied by extensive variations within the normal. The changes occurring in maternal blood have, therefore, been an interesting field of study in themselves, while comparative studies of maternal and fetal blood have given information concerning the mechanism by which the fetus obtains the materials essential to its growth and nutrition. A summary of the results of such investigations is included by Harding<sup>1</sup> in a general review of the studies concerning metabolism in pregnancy.

The special phase of this topic in which we have been interested is that of the acid-base equilibrium of the mother during gestation. The means by which this can be studied, determinations of alveolar carbon dioxide tension, plasma bicarbonate and plasma  $P_H$ , have all been employed by previous investigators. Thus, Hasselbalch and Gammeltoft<sup>2</sup> found a low alveolar carbon dioxide tension beginning during the second month of pregnancy and persisting. This has been confirmed by several observers, the most extensive series of determinations published being that of Rowe.<sup>3</sup> A lowered carbon dioxide combining power was found to exist during pregnancy by Loseé and Van Slyke.<sup>4</sup>

The determinations of  $P_H$  of the blood available at the time of the studies mentioned did not indicate any definite change and this, with the finding of low alveolar carbon dioxide tension and low plasma bicarbonate, became the basis for the impression that a compensated acidosis exists during pregnancy. Marrack and Boone,<sup>5</sup> however, found the reaction of the blood to be actually more alkaline than normal, while the facts previously presented would lead one to expect the reverse. This is of considerable importance, for if a compensated acidosis exists during pregnancy, the evidence available would indicate that excessive production of acids, postulated by various writers, is the mechanism responsible. The other possible explanation, that of defective elimination, can scarcely be suggested. The nonprotein nitrogen of the blood is lower than normal during pregnancy. Spald-

ing, Shevsky, and Addis<sup>6</sup> even found excretion of urea more rapid in proportion to blood urea in the case of the pregnant woman than in the nonpregnant. On the other hand, if the reaction of the blood is actually more alkaline than normal, excessive neutralization of acids could not account for all of the observations. Marrack and Boone, in fact, ascribe the findings to hyperpnea, by which carbon dioxide tension and plasma bicarbonate are lowered with production of a more alkaline plasma reaction.

#### PROCEDURES AND METHODS

In extending these studies we have obtained a number of blood specimens from each case at different times before delivery, and also one from ten to seventeen days postpartum. It is known that anatomic changes are still taking place in the puerperium after this time, and the process of lactation is an additional factor which must be borne in mind. The comparison of results obtained at this time with those during pregnancy has, however, been the most feasible approach to the problem of securing "control" observations on the same patients in each of thirty cases.

Special attention was given to the determination of the total carbon dioxide content and  $P_H$  of the plasma, although numerous other determinations were carried out as a check on the conditions of the patients. The subjects were normal pregnant women. A few cases in which evidence of nephritis developed during the course of observation were excluded from the series. The series, however, includes several cases in which hypertrophy of the thyroid was somewhat greater than that usually encountered. Minor disturbances were disregarded, since complete absence of these is rare in cases in which the records are sufficiently complete.

One to four blood specimens were obtained from each case during pregnancy, and one ten to seventeen days after delivery. The blood specimens were in all cases taken before breakfast. The technic used was that of drawing the blood, under oil, into a syringe of sufficient capacity to permit of all determinations being made on one specimen. Stasis was reduced to the minimum necessary, and after the vein was punctured the tourniquet was removed. About twenty seconds afterwards the 25 c.c. sample of blood was slowly drawn into the syringe. The 5 c.c. of blood for the  $P_H$  and carbon dioxide content determinations were discharged first, under oil, into a tube similar to that used by Myers, Schmitz, and Booher,<sup>7</sup> except that the portion of the tube above the constriction admits a large syringe. The remainder of the blood was discharged into a specimen bottle. Neutral potassium oxalate in amount of 0.2 gm. per 100 c.c. of blood was used as anticoagulant. All analyses were carried out within four hours after the blood was drawn.

Hemoglobin was estimated by the Newcomer method,<sup>8</sup> nonprotein nitrogen and sugar by the Folin-Wu methods,<sup>9</sup> uric acid by the method of Benedict,<sup>10</sup> urea by the method of Myers, Fine, and Lough,<sup>11</sup> and chlorides by the method of Myers and Short.<sup>12</sup>

TABLE I. DATA ON THE COMPOSITION OF BLOOD DURING PREGNANCY AND POSTPARTUM

DATE	NAME	LUNAR MONTHS		HEMO- GLOBIN	N.P.N.	UREA N.	URIC ACID	SUGAR	CHLO- RIDES (WHOLE BLOOD)	CHLO- RIDES (PLASMA)	CO <sub>2</sub> CONTENT (PLASMA)	PH
		PREG- NANT	POST- PARTUM									
				gm. per 100 c.c.	mg. per 100 c.c.	mg. per 100 c.c.	mg. per 100 c.c.	per cent	per cent	per cent	vol. per cent	
2/13/25	H.S.	8		11.4	22.2	10.6	2.3	0.085	0.512		50.4	7.48
3/ 4/25	"		16	13.5	24.0	12.1	2.9	0.082	0.500		57.7	7.45
2/16/25	A.M.	7		14.6	21.5	9.4	2.4	0.074	0.520		48.5	7.43
3/16/25	"	8		11.5	23.8	---	---	0.080	---		45.3	7.40
5/ 1/25	"	due		12.2	---	---	---	---		0.637	47.1	7.43
5/16/25	"		13	13.2	31.0	9.5	4.0	0.090	0.512	0.625	61.5	7.40
3/ 7/25	E.B.	10		12.2	---	9.5	---	0.088	0.519		45.7	7.41
3/21/25	"		13	9.9	33.3	8.4	---	0.084	0.495		55.7	7.42
2/16/25	I.S.	9		9.9	28.0	---	2.7	0.074	---		44.7	7.45
4/ 1/25	"		12	11.0	31.2	---	---	0.077	0.530		54.9	7.42
3/20/25	J.M.	9		11.1	---	---	2.7	0.073	0.531	0.650	40.4	7.45
5/ 1/25	"	due		12.4	---	---	---	---	0.522	0.645	42.4	7.46
5/18/25	"		11	11.0	45.5	18.2	4.0	0.127	0.512	0.650	47.3	7.44
2/ 7/25	L.S.	9		9.8	22.5	---	---	0.070	0.480		48.5	7.43
3/ 6/25	"	10		11.5	20.4	7.8	2.1	0.077	0.537		44.5	7.41
3/21/25	"		11	10.2	28.6	10.6	---	0.096	0.525		55.7	7.43
2/ 7/25	M.L.	8.5		13.7	26.2	8.6	---	0.083	---		49.0	7.45
3/ 7/25	"	10		12.3	24.8	8.0	2.9	0.068	0.512		47.5	7.43
4/ 1/25	"		14	13.5	34.8	---	---	0.083	0.519		55.8	7.42
2/ 7/25	M.S.	9		10.3	27.6	13.1	---	0.065	0.530		46.6	7.47
3/20/25	"		13	13.3	30.0	9.4	---	0.076	0.494		57.6	7.41
2/ 9/25	A.V.	7		8.8	25.2	8.3	2.2	0.080	0.531		---	7.39
3/13/25	"	8.5		11.9	---	---	---	---	0.518		49.4	7.39
5/12/25	"		12	13.7	34.9	---	4.6	0.092	0.512	0.637	60.7	7.38
3/ 2/25	T.B.	8		13.4	26.6	10.5	2.1	0.081	0.512		45.3	7.42
3/23/25	"	9		11.5	---	---	---	---	0.487		44.7	7.42
5/ 6/25	"		15	12.6	32.8	---	3.0	0.089	0.512		59.8	7.39
3/ 2/25	M.T.	10		13.2	32.1	---	2.9	0.069	0.505		38.5	7.41
3/ 9/25	"	10		10.5	28.5	9.7	2.6	0.075	0.487		48.3	7.41
3/25/25	"		13	10.5	30.3	13.7	---	0.085	0.531		56.0	7.43
3/28/25	V.R.	10		7.7	31.4	13.9	3.3	0.083	0.563	0.612	42.5	7.38
4/15/25	"		17	13.1	35.1	15.1	---	0.094	0.525		56.0	7.37
3/28/25	A.K.	10		12.5	28.0	13.6	3.7	0.081	0.519		48.2	7.41
4/15/25	"		17	14.5	31.9	15.0	---	0.091	0.500		57.0	7.43
3/27/25	L.S.	8		11.2	23.1	10.0	3.2	0.084	0.500	0.606	52.2	7.45
4/ 4/25	"	8		11.5	---	---	---	---	0.520		48.5	7.47
4/25/25	"	9		11.7	---	---	---	---	---	0.587	42.8	7.44
5/ 6/25	"	10		15.0	---	---	---	---	0.525	0.632	44.7	7.43
6/ 3/25	"		12	12.8	31.2	7.5	4.0	0.099	0.512	0.612	53.2	7.40
1/ 6/25	G.M.	7		---	---	14.8	3.6	---	0.545		50.4	7.48
3/13/25	"		14	13.9	---	---	---	---	0.506		57.9	7.42
5/ 4/25	D.B.	10		---	29.3	13.8	3.9	0.124	0.544	0.637	49.2	7.41
5/ 8/25	"	10		9.6	---	---	---	0.078	0.514	0.637	48.5	7.42
5/22/25	"		12	12.4	44.8	15.6	5.7	0.085	0.482	0.619	53.2	7.41

TABLE I—CONT'D

DATE	NAME	LUNAR MONTHS PREG- NANT	DAYS POST- PARTUM	HEMO- GLOBIN	N.P.N.	UREA N.	URIC ACID	SUGAR	CHLO- RIDES (WHOLE BLOOD)	CHLO- RIDES (PLASMA)	CO2 CONTENT (PLASMA)	PH
				gm. per 100 c.c.	mg. per 100 c.c.	mg. per 100 c.c.	mg. per 100 c.c.	per cent	per cent	per cent	vol. per cent	
5/ 4/25	L.B.	10		12.5	31.0	13.3	3.3	0.073	0.544	0.637	47.3	7.40
5/ 8/25	"	10		10.5	---	---	---	---	0.562	0.644	42.8	7.43
5/27/25	"		12	9.9	23.9	8.4	3.3	0.085	0.544	---	51.9	7.35
5/ 4/25	S.S.	10		14.5	31.3	13.2	3.5	0.082	0.488	0.625	47.3	7.42
5/ 8/25	"	10		13.5	---	---	---	---	0.535	0.644	49.4	7.44
6/ 3/25	"		14	12.3	34.9	10.2	4.6	0.091	0.494	0.600	65.5	7.35
2/ 9/25	M.B.	9		12.2	24.0	9.0	2.3	0.072	0.540		49.4	7.48
3/28/25	"		13	11.4	---	---	---	---	0.512		57.7	7.42
2/ 9/25	L.F.	9		8.0	26.5	8.1	2.3	0.078	0.540		50.4	7.46
3/ 6/25	"	10		9.6	25.0	10.8	3.2	0.076	---		50.2	7.44
3/30/25	"		17	8.5	31.6	---	2.8	0.104	0.512		53.0	7.43
2/11/25	F.K.	10		10.9	25.0	9.6	2.4	0.076	0.542		51.0	7.43
3/ 9/25	"		14	11.7	---	---	---	---	0.544	0.637	56.7	7.40
2/11/25	M.S.	9		8.5	20.8	8.4	2.6	0.069	0.542		42.4	7.45
3/ 9/25	"	10		7.3	30.0	11.2	3.6	0.083	0.562		45.5	7.40
3/25/25	"		15	8.1	25.6	11.9	---	0.094	0.506		50.4	7.43
2/11/25	H.C.	9		12.6	27.6	8.8	2.7	0.082	0.575		51.0	7.39
3/23/25	"	10		11.7	---	---	---	---	0.500	0.625	46.6	7.43
4/15/25	"		14	13.0	28.8	11.1	---	0.086	0.513		59.0	7.42
2/13/25	A.T.	10		10.9	28.5	14.2	2.5	0.071	0.512		46.6	7.44
3/ 6/25	"		14	11.3	32.5	17.1	3.5	0.083	0.507		54.0	7.44
2/14/25	M.B.	10		11.2	28.0	10.1	3.2	0.084	0.544		50.0	7.46
3/14/25	"		10	11.9	---	---	---	---	0.544	0.644	59.5	7.40
2/14/25	E.C.	10		11.7	---	10.4	3.5	0.078	0.533		49.0	7.49
3/16/25	"		14	14.3	32.0	13.1	---	0.094	0.482		55.7	7.45
2/14/25	B.M.	9		9.7	26.3	9.4	3.0	0.084	0.569		45.3	7.46
3/ 4/25	"	10		9.8	18.9	8.5	2.0	0.072	0.555		48.3	7.45
4/ 1/25	"		14	10.9	32.3	---	---	0.082	0.519		53.9	7.41
2/18/25	H.V.	8		12.8	27.3	7.4	2.4	0.090	0.506		50.0	7.51
3/ 4/25	"	9		11.7	17.3	6.1	2.2	0.076	0.494		47.3	7.44
3/14/25	"	10		10.9	---	---	---	---	0.531	0.620	53.8	7.36
4/ 4/25	"		12	11.8	30.0	---	---	0.085	0.487		59.8	7.41
2/18/25	V.H.	10		12.4	30.0	8.0	2.7	0.080	0.512		53.8	7.50
3/ 7/25	"		16	11.7	30.2	10.4	3.5	0.080	0.537		54.1	7.38
2/22/25	M.C.	8		15.2	29.8	9.7	---	0.080	0.535		48.3	7.50
3/13/25	"	9		12.4	---	---	2.7	---	0.537		49.4	7.42
3/27/25	"	10		16.0	---	---	---	---	0.506	0.625	50.2	7.45
4/24/25	"		14	13.2	28.4	9.1	---	0.084	---		60.7	7.42
2/22/25	C.S.	9		13.9	35.5	11.0	---	0.080	0.525		48.3	7.47
3/ 9/25	"	10		12.7	25.8	9.3	2.5	0.075	0.519		47.3	7.42
4/ 4/25	"		12	13.3	34.0	---	---	0.100	0.470		57.9	7.43
2/ 2/25	M.G.	7		11.7	22.4	8.9	1.8	0.080	0.550		49.2	7.42
3/23/25	"	8.5		10.6	---	---	---	---	0.519	0.625	50.4	7.43
5/ 6/25	"		11	12.9	34.2	---	2.8	0.088	0.537	0.637	62.6	7.38

The determinations of the hydrogen-ion concentration were carried out exactly as described by Myers, Schmitz, and Booher,<sup>7</sup> and in a preliminary report of the work<sup>12</sup> the figures given are those actually obtained. In the method as used in Professor Myers' laboratory at present, however, 5 per cent more indicator is added to the saline than before, to compensate for its subsequent dilution by the addition of 0.1 c.c. of plasma to 2 c.c. of saline. The results thus obtained for  $P_H$  are more alkaline by 0.03 than by the method as originally described. Accordingly 0.03 was added to every figure obtained.

Carbon dioxide content of the plasma was determined by the method of Van Slyke and Cullen<sup>14</sup> using a portion of the plasma which had been separated by centrifuging under oil for the  $P_H$  determination, and omitting the equilibration with alveolar air which is carried out when carbon dioxide combining power is determined.

## RESULTS

The results of all analyses are recorded in Table I. In the case of the substances usually determined in routine analyses, the findings are in keeping with those of other observers. The hemoglobin values are low, over 70 per cent falling between the limits of 10 and 13 grams per 100 c.c. of blood. There are a few cases, L. G., and M. S., in which the hemoglobin values were, however, lower than one would expect in normal pregnancy.

It is generally known that the total nonprotein nitrogen of the blood is decreased during pregnancy, and that urea nitrogen forms a smaller percentage of it than in other cases. In Table I there are 32 blood specimens drawn during pregnancy, and 18 drawn postpartum, for which both nonprotein nitrogen and urea nitrogen figures are available. The average nonprotein nitrogen value during pregnancy is 26.4, and for urea nitrogen 10.1 mg. per 100 c.c. The urea nitrogen is 38 per cent of the total nitrogen. In the postpartum blood specimens, eighteen in number, the average nonprotein nitrogen value is 31.6 mg., and that of urea nitrogen 12.1 mg. per 100 c.c. The low nonprotein nitrogen is thus restored approximately to the usual normal figure ten to seventeen days after delivery, but the urea nitrogen remains 38 per cent of the total nonprotein nitrogen.

In most of the cases the uric acid content of the blood is definitely higher in the postpartum specimen than in those drawn during pregnancy, but in view of the fact that hemoglobin and total nonprotein nitrogen both increase, the finding is of little significance.

The data on carbon dioxide content and  $P_H$  are of special value, in our opinion, because the series cover a sufficiently large number of cases, and because blood from the same patients was obtained during pregnancy and after delivery. It was also drawn by the same person, under practically identical conditions. This should minimize variations incident to technic and methods.

The findings in this connection are that while the carbon dioxide content, after delivery, almost invariably rises from its lowered level during pregnancy to a nearly normal level, the reaction of the blood

TABLE II. SUMMARY OF CARBON DIOXIDE CONTENT DETERMINATIONS RECORDED IN TABLE I

CO <sub>2</sub> CONTENT VOL. PER CENT	NUMBER OF DETERMINATIONS	
	DURING PREGNANCY	POSTPARTUM
38-41	2	0
42-45	13	0
46-49	27	1
50-53	11	5
54-57	2	12
58-61	0	12
62-65	0	0

TABLE III. SUMMARY OF  $P_H$  DETERMINATIONS RECORDED IN TABLE I

$P_H$	NUMBER OF DETERMINATIONS	
	DURING PREGNANCY	POSTPARTUM
7.35-7.36	1	2
7.37-7.38	1	4
7.39-7.40	6	5
7.41-7.42	13	11
7.43-7.44	15	8
7.45-7.46	10	2
7.47-7.48	6	0
7.49-7.50	3	0
7.51	1	0

becomes less alkaline; conversely, that while the carbon dioxide content of the blood is lower during pregnancy than ten to seventeen days after delivery, the blood is slightly more alkaline during pregnancy. The findings for carbon dioxide content are given in Table II.

During pregnancy half of the values for carbon dioxide content fall between 46 and 49 volumes per cent, and practically all of them between 42 and 53 volumes per cent. In the same cases after delivery, the carbon dioxide content has increased so that of 34 determinations 24 fall between 54 and 61 volumes per cent, the usual normal for non-pregnant individuals, and an increase of at least 10 volumes per cent above the mean during pregnancy.

In Table III the data on hydrogen-ion concentration, taken from Table I, are systematized in a similar manner. Omitting  $P_H$  differences smaller than 0.02 minimizes the observed changes. However, the mean value in postpartum bloods is still 0.02 less alkaline than the mean value during pregnancy. With this, 19 per cent of the postpartum specimens gave values between 7.35 and 7.38, while only 4 per cent of the specimens during pregnancy gave  $P_H$  values as low as this; and 18 per cent of the bloods during pregnancy gave results between 7.47 and 7.51, while none of the postpartum bloods were so alkaline. The normal limits for  $P_H$  were given by the authors of the method used<sup>7</sup> as 7.35 to 7.43. Introducing the correction of 0.03 mentioned above, the limits would be 7.38 to 7.46. Of the 32 postpartum specimens, 30 fell within these limits. Since the comparison thus far has been between bloods drawn during pregnancy and those obtained ten to seventeen days after delivery, it is gratifying to find that the latter

have the same carbon dioxide content and reaction as blood specimens from other cases in which there is no reason to expect any disturbance of acid-base equilibrium.

Since the colorimetric method used in determining  $P_H$  is based on that of Cullen,<sup>15</sup> the limitations of the latter method apply. The validity of the above comparison between the pregnant, puerperal, and nonpregnant, depends upon the assumption that the average correction factor is the same for the three groups if the observations cover a sufficient number of cases.

### CONCLUSIONS

During pregnancy the reaction of the plasma is slightly more alkaline than normal, although plasma bicarbonate is lower than in the nonpregnant. Early during the puerperium the bicarbonate values increase, while the reaction of the plasma becomes slightly more acid, both values returning to the normal range for nonpregnant individuals. The plasma  $P_H$  values found during pregnancy in this series of cases are not as alkaline as those of Marrack and Boone, but qualitatively the results are similar.

In two of three carefully studied cases, Zuntz<sup>16</sup> found that the volume of air respired per minute increased over 60 per cent during pregnancy. The factor of increased ventilation is thus a very large one. Increased acid production during pregnancy is not altogether excluded by our findings. It occurs in nonpregnant individuals without alteration of the normal  $P_H$  values, and might occur in pregnancy without altering the slightly more alkaline reaction produced by increased ventilation. But since the latter factor alone is known to produce the results observed, low carbon dioxide tension, low plasma bicarbonate, and high  $P_H$ , the low plasma bicarbonate cannot be regarded as evidence for increased acid production during pregnancy.

We are indebted to Professor V. C. Myers and Professor F. H. Falls for valuable suggestions and criticisms in connection with these studies.

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# CAUSATION OF FETAL DEATH

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THIS paper is based on observations made in the obstetric service of the Philippine General Hospital from 1917 to October 30, 1925—a period of almost nine years. The number of viable births is 8,329, 1003 of which represent stillbirths and neonatal or postnatal deaths. Stillbirths are those babies born during the period of viability without any signs of life; neonatal, those dying during the first five days of extrauterine life. In the United States, the neonatal deaths include those deaths occurring during the first two weeks of life after delivery. This classification cannot be followed in these cases, because our patients are discharged at the average of five days after delivery, our service being far from ideal with regard to postpartum care.

TABLE I. CLASSIFICATION OF FETAL DEATHS

Total number of births	8,329
Total number of living births	7,326
Total number of neonatal or postnatal deaths	261
Total number of stillborn, fresh	555 55.33%
Total number of stillborn, macerated	122 12.16%
Total number of stillborn, mutilated	65 6.48%
Total number of stillborn, postnatal	261 26.02%
Total number of fetal deaths	1,003

The fetal deaths are grouped under four headings; namely, (1) stillborn, fresh; (2) macerated; (3) mutilated; (4) neonatal.

TABLE II

	NUMBER OF CASES	%
1. Obstetrical interventions	153	27.56
2. Placenta previa	94	16.93
3. Obstetric interventions complicated by coexisting pathologic entities	75	13.51
4. Prolonged labor	55	9.90
5. Undetermined	34	6.12
6. Eclampsia	33	5.94
7. Diseases complicating pregnancies	27	4.86
8. Prolapsed cord	22	3.96
9. Transverse presentation and face (1)	21	3.78
10. Premature separation of a normally implanted placenta	13	2.34
11. Prematurity	11	1.98
12. Anatomic anomalies	8	1.44
13. Strangulation secondary to winding of cord around neck	5	0.90
14. Syphilis (Wassermann positive, 3)	4	0.72
Total	555 cases	



1. *Stillborn, Fresh.* (55.33 per cent.) These are fetuses who showed signs of recent death but beyond the power of resuscitation. It is not easy to determine whether the death is due to intranatal causes.

Intranatal asphyxia may undoubtedly have resulted from the following causes of death: placenta previa, eclampsia, prolapse of the cord, premature separation of a normally implanted placenta, winding of the cord around the neck. Traumatism may have been the cause also of death under obstetric interventions, under interventions complicated by coexisting pathologic entities, under prolonged labor, under transverse presentation and face (compound presentation). There were 34 cases, however, whose cause of death could not be ascertained. Prematurity alone as a cause of stillbirth (fresh) is hard to understand if we do not take into account that probably these babies were weak or weakened by some pathologic condition of the fertilized ovum or as in cases where general diseases such as typhoid, tuberculosis, nephritis, cardiac decompensation, etc., complicating pregnancies, the fetuses usually succumbed through pressure during the different stages of labor. This presumption is borne out by pathologic findings at autopsy which will be discussed in the latter part of this paper.

TABLE III. MUTILATED FETUSES (6.48%)

	NUMBER OF CASES	%
1. Decapitation -----	35	53.84
2. Craniotomy -----	30	46.15

TABLE IV. MACERATED BABIES (12.16%)

	NUMBER OF CASES	%
1. Undetermined -----	28	22.95
2. Transverse presentation -----	24	19.67
3. Placenta previa -----	18	14.75
4. Syphilis (Wassermann positive in 12, clinically positive in others) -----	13	10.66
5. Prolonged labor -----	8	6.55
6. Breech presentation -----	8	6.55
7. Diseases complicating pregnancy -----	7	5.73
8. Premature separation of a normally implanted placenta -----	3	2.45
9. Premature rupture of the bag -----	3	2.45
10. Rupture of the uterus -----	2	1.63
11. Fall -----	2	1.63
12. Prolapsed cord -----	1	0.81
13. Anatomic anomaly -----	1	0.81
14. Compound presentation -----	1	0.81
15. Abdominal pregnancy -----	1	0.81
Total -----	122	

As a rule, destructive operations should only be performed when the diagnosis of fetal death has been positively established. This principle was followed strictly on all shoulder presentations where

decapitation was done. In the craniotomies, however, there were seven babies on whom forceps application had been attempted, and on failure at extraction, craniotomy was resorted to; there were also eight cases on whom breech extraction was performed but the after-coming heads were found to be disproportional with the canal—three of them being hydrocephalic, one with multiple cysts in the head and the rest were due to overdevelopment.

Syphilis as a cause of fetal death occupies the fourth place among macerated fetuses. Wassermann reaction was positive in 12 out of 13 cases. Except syphilis, the causation of macerated fetuses, may be considered as due to the prolonged stay of the dead fetuses inside the uterus, from two to five days. The diagnosis of maceration was not difficult for the foul odor was evident even at a distance. In one case, however, while decapitation was being performed and a small cut was being made at the axillary region of the prolapsed hand, the fetus was found living, by direct palpation of the fetal precordial area. Podalic version was performed and a living male baby was extracted. The cut was sutured and the baby was discharged in good condition. This was the only case that could be singled out as living from all the foul and infected cases.

TABLE V. NEONATAL DEATHS (25.02%)

	NUMBER OF CASES	%
1. Congenital debility -----	87	33.33
2. Prematurity -----	54	20.68
3. Obstetric intervention -----	42	16.09
4. Anatomic anomalies -----	15	5.74
5. Asphyxia -----	13	4.98
6. Placenta previa -----	10	3.83
7. Obstetric intervention complicated by coexisting pathologic entities -----	10	3.83
8. Hemorrhages of the newborn -----	10	3.83
9. Diseases complicating mother -----	7	2.68
10. Prolonged labor -----	4	1.53
11. Eclampsia -----	3	1.14
12. Congenital syphilis (Wassermann positive) -----	2	0.76
13. Diseases of the newborn -----	2	0.76
14. Undetermined -----	2	0.76
Total -----	261	

Neonatal deaths constituted 25.02 per cent of the total fetal mortality. Congenital debility and prematurity have the greatest toll. At times they may be considered independent of each other but in the majority of cases, other things being equal, these two factors must be regarded as one. These premature babies or babies congenitally weak might give a healthy cry at birth and might finally show improvement after they have been put in the incubator but cyanosis may recur. This cyanosis is accompanied by convulsions or even by characteristic facies sardonius so that not a few consider them as

tetanus neonatorum. Happily not one case has been found to have died from tetanus neonatorum but from atelectasis pulmonum as evidenced by the autopsy findings. There were only two cases of congenital syphilis, blood of mother and babies being Wassermann positive.

#### COMMENTS

The practical question to ask is: "What rôle does the physician have in the causation of fetal death?" To answer this question the following points should be analyzed:

(1) When the patients were seen, (2) congenital anomaly, (3) obstetric interventions performed, (4) complications present when interventions were made, and (5) the autopsy findings.

1. Most of our patients belong to the Filipino common people who do not see or who have not yet formed the habit of seeing the doctor early. Most of our cases of placenta previa, eclampsia, and prolonged labor were seen after efforts at delivery outside had failed or after several hemorrhages or after convulsions had already taken place. Williams<sup>1</sup> emphasized strongly the importance of prenatal care. Balantyne<sup>2</sup> stated that by prenatal care modern obstetric practice has ceased to be sensational in that many of the cases which would otherwise have terminated dystocic were rendered normal. In this connection, may I mention that in my personal cases, either private or dispensary, on whom supervision during pregnancy had been practiced, eclampsia was entirely eliminated. There were two cases, however, in which blood pressure was found to be 172 and 196 systolic, respectively, the latter already having dimness of vision and intense headache. Neither of them developed actual convulsive fits following absolute rest, purgation and alkalinization. The first delivered spontaneously, the second by forceps, not on account of the preeclamptic condition which had been controlled but by an indication of forceps application. Probably, the 35 cases of death due to eclampsia in these series, could have been prevented had they had close prenatal care before actually coming to the natal period when convulsions set in. The same can be said of the 124 cases, the cause of death of which was the different types of placenta previa. Most of the cases were admitted after they had bled to exhaustion, the fetuses dying from asphyxia because of the faulty oxygenation from the placental circulation. Not a few cases, however, had come early enough to have the benefit of hospitalization, but by adopting too much the "watchful waiting policy" for spontaneous deliveries, not only did we lose the babies but also the mothers through exsanguination.

The fetal deaths due to prolapsed cord (24 cases); to winding of the cord around the neck of the fetus (4 cases); to premature separation of a normally inserted placenta (13 cases); all these were seen after intranatal asphyxia had already taken place.

2. Those fetuses showing anatomic defects—congenital eventration (2 cases); anencephaly (3 cases); hydrocephalus (8 cases); oligohydramnios (3 cases); hydramnios (2 cases); encephalocele (1 case); ascitis (1 case)—all were and are beyond the power of any remedy.

3. In this series, there were performed the following operations to save the fetus, but which resulted fatally during or immediately after labor:

	CASES
Breech extraction -----	74
Podalic version -----	64
Midforceps -----	38
Low forceps -----	29
High forceps -----	9
Hysterectomy (ruptured uterus) -----	6
High forceps and pubiotomy -----	1
Low forceps and pubiotomy -----	1
Cesarean section -----	1
Total -----	<u>222</u>

This constitutes 22.23 per cent of the total deaths, a figure which is not very high when compared with that by Wilson<sup>3</sup> of approximately 50 per cent, by Bailey<sup>4</sup> of 35 per cent, and by Edgar<sup>5</sup> of 24 per cent.

4. The total number of cases with interventions including placenta previa, eclampsia, nephritis, cardiac decompensation, were 85, or 8.47 per cent, of the whole fetal mortality. It is obvious that the presence of these complications increases the dangers from obstetric interventions, since these diseases per se may cause fetal death. No literature concerning this point could be found so that we cannot make any comparison.

The following diseases in the mother were found to have caused fetal death:

	CASES
Syphilis -----	19
Typhoid fever -----	6
Tuberculosis -----	4
Malaria -----	3
Influenza -----	3
Toxemia of pregnancy -----	2
Septicemia -----	1
Total -----	<u>37</u> cases or 3.68% of total mortality.

It will be noted that syphilis as a cause of fetal death is 1.88 per cent. Browne<sup>6</sup> reported 17.5 per cent of stillbirths as due to syphilis. Williams<sup>7</sup> gives 34 per cent of 302 cases. Fetal death, as experience bears out, is preventable among syphilitics if treatment is instituted during the course of pregnancy.

5. It is to be regretted that only 45 fetuses were autopsied out of 1003 cases. Among the neonatal deaths in which intervention was done, the anatomic findings were as follows:

	CASES
Asphyxia due to mucous obstruction .....	1
Antenatal peritonitis .....	1
Meningeal hemorrhage .....	2
Hydrocephalus, internal, bilateral .....	1
Hydrocephalus, internal and extradural .....	1
Eclampsia and congenital debility .....	1
Hemoperitoneum .....	2
Congenital atrophy .....	2
Congenital debility and prematurity, no apparent pathologic cause of death .....	1
Subpleural hemorrhage and partial atelectasis of lungs .....	1
Atelectasis pulmonum, recurrent .....	5
Petechial hemorrhages (lungs) and congestion of viscera .....	2

The following pathologic findings were found in the neonatal deaths in which some obstetric interventions were made.

	CASES
Hydroperitoneum and hydrothorax .....	1
Epieranial hemorrhage (version) .....	1
Premature fetus .....	1
Congenital syphilis .....	3
Congestion of blood vessels in arachnoid .....	1
Meningeal hemorrhage and meningitis acute .....	4
Passive congestion of all viscera (breach extraction) .....	1

The pathologic findings in stillborn (fresh) are the following:

	CASES
Meningeal hemorrhage, basal; cephalohematoma; atelectasis pulmonum (head impaction) .....	1
Hemorrhage, gastrointestinal .....	1
Hemorrhage into middle and posterior cranial fossa, prolapsed cord and podalic version .....	1
Petechial hemorrhages in and edema of the brain, spontaneous delivery .....	7

There were only three cases of macerated fetuses which were autopsied. The pathologic report only stated: maceration.

These findings tend to show to what extent a physician can be held responsible for fetal death which may be attributed to his training or to accidents in labor. When we bear in mind that even in spontaneous deliveries, the pathologic findings would point out to some pressure more or less powerful, there would be less tendency on our part to condemn the operator, although there is no denying that injudicious intervention undoubtedly works havoc not only to the babies but also to the mothers. The fetuses might be congenitally weak or might be complicated by some pathologic or congenital anomaly so that the final outcome is always doubtful.

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# FOLLICULAR SALPINGITIS, AN IMPORTANT FACTOR IN THE ETIOLOGY OF ECTOPIC GESTATION\*

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THERE is no lack of theories concerning the etiology of tubal pregnancy. An examination of any standard textbook on gynecology will show one or more pages devoted to a discussion of the various etiologic factors. The question to consider is not so much which is correct, as they all probably cause an occasional tubal pregnancy, but which of these various factors or processes, if any, is of the most universal application.

Kelly<sup>1</sup> states that any interference with the downward passage of the fertilized ovum through the tube may cause an extrauterine pregnancy. Determination of the exact pathologic process which may cause interference with the downward passage of an impregnated ovum toward the uterus is difficult in spite of the large number of specimens obtained at operation. In such material the process has usually progressed so far as to obscure the primary etiologic factor.

All attempts to produce tubal pregnancy in animals have failed; apparently the human organism alone suffers from ectopic gestation. Bland-Sutton<sup>2</sup> states, "I have failed to find a single convincing record or specimen, but there are very many cases recorded in which puppies and kittens enclosed in tightly fitting sacs have been found adherent to the omentum and intestines."

Loeb and Hunter<sup>3</sup> state that in guinea pigs, occlusion of the fallopian tubes did not bring about a tubal pregnancy through the mere retention of the ovum in the fallopian tube. Novak<sup>4</sup> attempted to produce ectopic gestation in white rats by ligating the normal tubes several hours after copulation, but like Tainturier,<sup>5</sup> von Mandl and Schmidt,<sup>6</sup> he was unsuccessful.

Since the causative factor cannot be determined by a study of the ectopic material and since tubal pregnancy cannot be experimentally produced in animals, the etiologic factor must be sought for in other portions of the tube. The condition which produced the interference with the passage of the ovum must have occurred in other areas besides the particular spot in which the implantation took place; therefore a study of the proximal end of the pregnant tube and of the opposite tube when available should show areas containing the same pathologic changes as those which existed in the ectopic area prior to the implantation of the ovum. In the present study the proximal end of the pregnant tube and occasionally the whole of the opposite tube

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when available were sectioned. Early in this study it was conceded that no single causal factor could be applied to all cases; however, in agreement with most authors it was found that some type of infection in the tube plays the major rôle. That salpingitis is probably the most frequent etiologic factor is borne out by the fact that most observers have been able to elicit a history of previous inflammation. (C. D. Williams,<sup>7</sup> Ott,<sup>8</sup> and Runge.<sup>10</sup>)

Of the inflammation of the tube, gonorrhea is probably the most frequent. Grove<sup>11</sup> was able either to obtain the gonococcus from the patient or found that the husband gave a recent history of gonorrhea in five out of seven cases. Rabinovitz<sup>12</sup> from an examination of 147



Fig. 1.—Mild salpingitis, degenerated cells, desquamating epithelium, serum, and bacteria in the lumen of the tube. The folds are swollen due to edema and infiltration with polymorphonuclear leucocytes, round cells, red blood cells, etc.

tubal pregnancies believes that gonorrheal salpingitis is the predominant cause of tubal pregnancy. Hahn<sup>13</sup> on the basis of a study of 246 cases from Vienna hospitals, comes to the conclusion that gonorrhea is the commonest cause of extrauterine pregnancy. Negative evidence is offered by Ahfeld,<sup>14</sup> Grove,<sup>15</sup> and DeLee,<sup>16</sup> who believe that the low incidence of ectopic gestation in rural communities is due to the rarity of gonorrheal infections. However, too much stress should not be laid upon gonorrhea as it is not the only infecting organism that may bring about changes in the lumen of the tube which appear to predispose to ectopic gestation; any low grade infection of the tube may bring about these changes.

The fact that the impregnated tube, or the opposite tube, on gross examination appears to be normal is not sufficient evidence to rule out a previous salpingitis, because the infection may have been caused by an organism of low virulence which leaves the tube quite normal to macroscopic examination but causes marked changes in the microscopic appearance of the lumen. However, the demonstration in the opposite tube of an old salpingitis by adhesions to the surrounding structures can be taken as definite evidence of an inflammation having existed in the ectopic tube.

Rapidly reviewing the changes that take place in a tubal infection, it is found that if the infection is of sufficient severity to completely destroy the lumen of both tubes or occlude their fimbriated ends, ste-

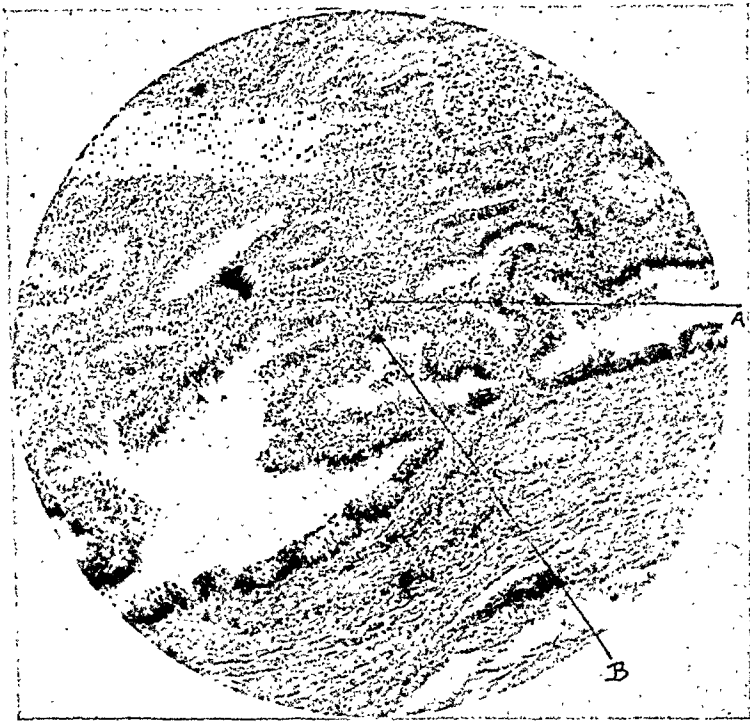


Fig. 2.—Healing of mild salpingitis. A, Connective tissue of the folds which have become confluent. B, Epithelium lining under surface of confluent stroma forming gland-like spaces.

rility results. If the infection is not so severe, the path for spermatozoae may remain open but the downward passage of the impregnated ovum may be interfered with. How this is brought about can readily be seen from a study of the lumen of the tube during a moderately acute inflammation and its healing process. In the acute stage, the tube is found to be filled with degenerating cells, desquamated epithelium, red blood cells, serum and bacteria (Fig. 1). The tubal folds are swollen and infiltrated and as the process extends, there is a loss of cilia and epithelium. When the tissues overcome the infection, and the healing begins, there is an absorption of the exudate and a regeneration of the lost tissue. The epithelium nearest to



the tubal wall usually begins to regenerate first and covers the stroma of the folds forming epithelium lined spaces. Most authors attribute the origin of these spaces to adhesions between the folds of the mucosa; this does not agree with the conclusions arrived at in the present study. It seems that a large part of the epithelium covering the folds is destroyed by the infection. Following the loss of the epithelium, the stroma of the folds, being very edematous, markedly infiltrated and in close apposition, becomes confluent. When the epithelium at the base of the folds regenerates, it lines the adjacent edges



Fig. 3.—Pseudoglands or tubal labyrinth along the wall of the tube.

of the folds and the undersurface of the confluent stroma, thereby forming gland-like spaces. (Fig. 2.) The resulting condition is known as follicular salpingitis or tubal labyrinth. Reconstruction of these gland-like spaces shows them in the main to run parallel with the lumen of the tube. They may be open at both ends, closed at one end or closed at both ends. The open ends of the gland-like spaces may communicate directly with the lumen of the tube. It is therefore quite easy to understand how an impregnated ovum traveling down the tube may be lodged in one of these gland-like spaces and develop there as a tubal pregnancy.

These pseudoglands may be found in three places, (a) along the wall of the tube (Fig. 3), (b) filling the lumen of the tube (Fig. 4), (c) in the wall of the tube (Fig. 5). The formation of the first type has already been explained. The second type is probably due to a

reversion of the epithelium to type. This epithelium is derived from müllerian duct epithelium; under the stimulation of the infection there is a reversion of the epithelium to its original type with the formation of an adenoma or gland-like structure. The third type may be formed in one of three ways: first, as an outgrowth of the epithelium to line the cavity of a mural abscess which has ruptured into the lumen of the tube (salpingitis nodosum); second, the epithelium under stimulation of the infection has undergone a metaplasia and a true gland is formed which grows outward into the wall of the tube; third, C. D. Williams<sup>17</sup> states there may be a hyperplasia of the con-



Fig. 4.—Gland-like spaces almost filling the lumen of the tube.

nective tissue where the edges of the fold have adhered and thus the epithelial cells are forced outward until they occupy a position in the wall of the tube.

These gland-like formations may be few, occur only on one spot, or they may be so profuse as to give the tube the appearance of a sieve. Webster<sup>18</sup> in his monograph on "Ectopic Pregnancy" states that in a case where he examined the nonpregnant tube a large part of the lumen possessed a mucosa of more or less uniform thickness filled with gland spaces lined with epithelium, as in Fig. 5.

In this study, based upon the microscopic examination of 50 tubal pregnancies, a tubal labyrinth formation was found in 46 cases.

Opitz<sup>19</sup> in 1902 found a definite inflammatory lesion in 12 of 23 specimens examined, and a follicular salpingitis in every instance. He also found a similar lesion in the nonpregnant tube, whenever it was available for examination. Ker-

mauner<sup>20</sup> and J. W. Williams<sup>21</sup> have made the same observations and although they believe that such a condition may cause the arrest of an impregnated ovum, they hesitate before giving it too general acceptance. They state, however, that it is the only pathologic condition of the tube which has been demonstrated in the largest number of cases.

Prussman<sup>22</sup> found adhesions between the folds of the mucosa in 20 out of 28 cases examined. These adhesions between the folds occur remote from the pregnancy.

C. D. Williams<sup>23</sup> found these false diverticulæ or channels not only in every tube in which the ovum has rested but also in the opposite side.

Kelly<sup>24</sup> states that he believes extrauterine pregnancy is simply due to some interference with the downward passage of the fertilized ovum through the tube. If this is true, one can readily understand how this pseudogland formation may interfere with the passage of an ovum and form a tubal pregnancy.

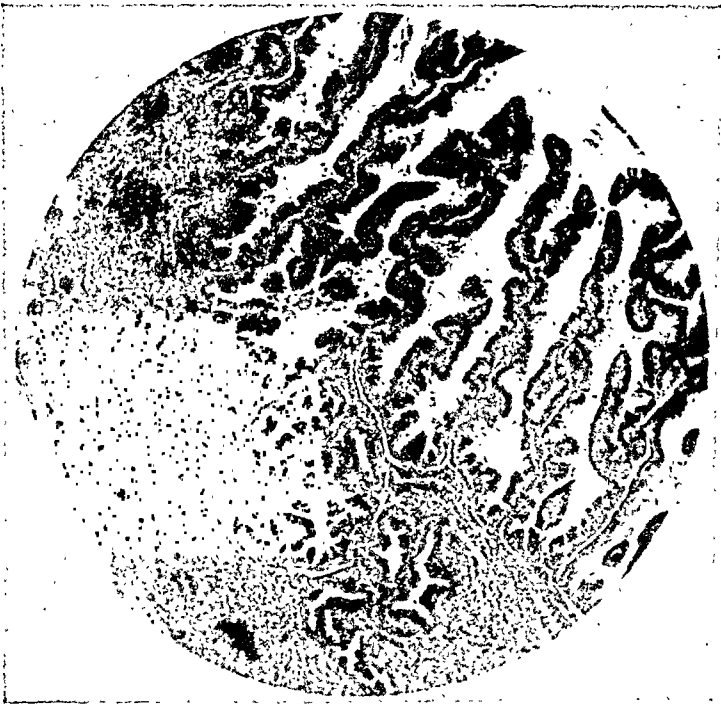


Fig. 5.—Gland-like spaces growing into the wall of the tube.

E. Bumm<sup>25</sup> states that when one is able to examine the tube shortly after the pregnancy has begun, the demonstration of the formation of blind sacs into which an ovum may find its way is not unusual. He also states that this is not an infrequent agent in the causation of tubal pregnancy.

Schoenholz<sup>26</sup> agrees absolutely as to the histopathology that there is a lattice work, etc., but he is convinced that this lattice work is congenital in origin, a maldevelopment of the müllerian ducts. From the present study it would seem that this is rather a reversion of the müllerian glandular epithelium brought about by inflammation than a congenital anomaly. This pseudoglandular formation (follicular salpingitis) is found regularly after inflammatory conditions in the tube and is rarely found in tubes that have not been the seat of some inflammatory changes. Schoenholz found this follicular condition in 26 out of 38 tubal pregnancies.

This pseudogland formation does not occur in all parts of the tube with equal frequency. It is rarely seen at the isthmus, more often at

the infundibulum and most frequently in the ampulla. This bears a direct relationship to the frequency of ectopic gestation in the various parts of the tube.

In the interstitial portion there are very few folds; as a result the pseudogland formation is rarely found. Interstitial pregnancy is the rarest type of tubal pregnancy. Rosenthal,<sup>27</sup> in a study of literature up to 1896, found 1324 ectopics with isthmal ectopics in 40 cases or 3 per cent. Oastler<sup>28</sup> found it twice in 100 cases. Wynne<sup>29</sup> in 1918 studied 1547 cases and found interstitial pregnancy 18 times or 1.16 per cent. Di Palma,<sup>30</sup> studying our statistics at Harlem Hospital, found it four times in 140 ectopic pregnancies.

At the ampulla, where follicular salpingitis is found most frequently, ectopic pregnancy was found by Foskett<sup>31</sup> 64 times in 117 ectopic pregnancies. Oastler found it 38 times in 74 recorded cases.

In the infundibulum, the pseudoglands are found almost as frequently as they are in the ampulla. Foskett<sup>31</sup> found tubal pregnancy at the infundibulum 52 times to 64 at the ampulla. Oastler found pregnancies at the outer portion of the tube 32 times to 38 in the ampulla.

The site of the tubal impregnation follows so closely the site of occurrence of the follicular salpingitis that there seems to be more than an accidental relationship between these factors.

#### CONCLUSIONS

1. An inflammation of the tube or a history of an infection has been found in a very large percentage of cases of ectopic pregnancy.

2. The end-result of a mild infection of the tube is the production of pseudoglands or a follicular salpingitis in a large portion of cases.

3. The frequency of the site of the ectopic nidus corresponds to the sites of the follicular changes in the tube.

4. Since C. D. Williams in all his cases (number not stated), Opitz in all his cases (23) and in this study of 50 cases, follicular salpingitis was found to be present in 46 instances, it would seem that follicular salpingitis is the etiologic factor in 90 to 95 per cent of all tubal pregnancies.

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ONE WEST EIGHTY-SIXTH STREET.

## INFLAMMATION OF THE AMNION AND CHORION\*

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THE occurrence of intrauterine infection under certain conditions during labor has long been known. More recently, histologic and bacteriologic studies have given additional information concerning the mode of origin and the significance of the infection and suggest further investigation. The present widespread employment of cesarean section, and the more general realization of its dangers in the presence of intrauterine invasion by bacteria lend the subject added importance.

Following entrance of bacteria into the uterus during labor, there are inflammatory reactions of both maternal and fetal tissues. Harris<sup>1</sup> has called attention to the former. It is known that the placental amnion and chorion likewise may show an acute inflammatory exudate of leucocytes, and in some instances bacteria may be found in the tissues.<sup>2</sup> This process differs from that secondary to preexisting gonorrheal endometritis in that the amnion and chorion rather than the placental decidua show inflammation. The inference is that the reaction on the fetal surface of the placenta indicates infection from that side. The frequent association of nonsyphilitic inflammation of the umbilical cord with the process in the amnion and chorion was pointed out by Creadick,<sup>3</sup> and this and other important observations of his are confirmed in whole or part by this study and a previous one of the same material.<sup>4</sup>

Microscopic studies were made of one thousand consecutive placentas from the seventh lunar month to term. Forty-eight (4.8 per cent) showed a definite inflammatory reaction in the amnion and chorion. In seven of these placentas, bacteria were demonstrated by appropriate staining, the organisms being short-chained, gram-positive cocci in each instance. In no case was there clinical or histologic evidence of gonorrhea or syphilis.

\*Read before the Detroit Obstetrical and Gynecological Society, February 6, 1928.

The relationship of temperature elevation to inflammation of the amnion and chorion is of interest, since it is often assumed that the presence of fever indicates the incidence of intrapartum, uterine infection. Among the one thousand deliveries there were seventeen with temperature elevations during labor to at least 100° F., which could not be explained by any intercurrent condition, such as pyelitis or acute respiratory infection. Since in fifteen of these seventeen cases the amnion and chorion of the placenta were acutely inflamed, it seems justifiable to assume that unexplained fever during labor is good evidence of intrapartum infection. On the other hand, thirty-three (nearly 70 per cent) of the forty-eight cases having such a degree of infection as to be evident histologically in the placenta (two by bacteria in the tissues) were without fever during labor. Therefore, it by no means holds that normal temperature is a reliable indication of the absence of intrauterine invasion by bacteria. This is in confirmation of the findings of Harris<sup>1</sup> in the histologic examination of uteri removed immediately following cesarean section and of Harris and Brown<sup>5</sup> in their bacteriologic study of uterine contents at the time of cesarean section.

As factors in the occurrence of intrapartum infection it is usually considered that premature rupture of the membranes and prolonged labor are foremost, and a study of this series is confirmatory, in part at least. In the tabulation it is seen that a division of the forty-eight

TABLE I. RELATION OF INFLAMMATION OF THE AMNION AND CHORION TO RUPTURE OF THE MEMBRANES, LENGTH OF LABOR, ETC.

RUPT. OF MEMBRANES BEFORE DELIVERY	NUMBER OF CASES	FEVER		VAGINAL EXAMINATIONS	BACTERIA IN TISSUES
		ANTE-PARTUM	POST-PARTUM		
Less than six hours	19	2 (11.1%)	7 (36.8%)	4	1 (5.25%)
	11 Labor under 15 hr.	0	4	1	1
	8 Labor 15 hr. plus	2	3	3	0
Six to twenty-four hours	12	3 (25%)	6 (50%)	3	1 (8.3%)
	6 Labor under 15 hr.	2	3	1	1
	6 Labor 15 hr. plus	1	3	2	0
Twenty-four hours and over	17	10 (58.8%)	7 (41.2%)	4	5 (29.4%)
	7 Labor under 15 hr.	4	1	0	1
	10 Labor 15 hr. plus	6	6	4	4
Total	48	15 (31.25%)	20 (41.7%)	11	7 (14.6%)
	24 Labor under 15 hr.	6 (25%)	8 (33.3%)	2	3 (12.5%)
	24 Labor 15 hr. plus	9 (37.5%)	12 (50%)	9	4 (16.6%)

cases of inflammation according to rupture of the membranes within six hours of delivery, between six and twenty-four hours, and over twenty-four hours yielded groups of about the same number; namely, nineteen, twelve, and seventeen, respectively. However, a study of the whole series of one thousand deliveries showed groups (with the same criteria) of 731, 192, and 77, thus, giving an increasing incidence of inflammation of the amnion and chorion according to the earlier rupture of the membranes of 2.6, 6.3, and 22.1 per cent. The last figure is in agreement with Slemons<sup>6</sup> for premature rupture of the membranes. Bacteria were found only one time in each of the first two groups and five times in the last.

The duration of labor as a factor is indicated by an average length of labor of approximately nineteen hours for this group of twenty-eight primiparas and twenty multiparas. However, there were only eight labors lasting thirty hours or over, and the unusual length of several of these accounts in part for the rather long average for the series. Indeed, one-half of the labors lasted less than fifteen hours, and ten of these were less than six hours. Bacteria were found in the placental tissues three and four times, respectively, in the two equal groups formed according to whether the duration of labor was more or less than fifteen hours.

Of other possible predisposing causes of intrapartum infection, mention should be made of vaginal examinations. The incidence of these (eleven out of forty-eight or 23 per cent), though more than twice that for the whole series of one thousand, fails to give an explanation for the majority of cases. However, it serves to emphasize the increased danger of infection following such examinations.

The danger of intrapartum infection to the woman in labor has been studied by many workers, notably Warnekros<sup>7</sup> and Slemons.<sup>6, 8</sup> The former found bacteria in the blood stream of eighteen out of twenty-five women with intrapartum temperature of 38.5° C. or more, and in one patient the condition resulted in septicemia. Slemons stated that 63 per cent of women with intrapartum infection have febrile puerperia, and 6.2 per cent die. Among the forty-eight women in this series with intrapartum infection, as evidenced by inflammation of the amnion and chorion, there were twenty or 41.7 per cent with temperature elevations to at least 100.4° F. (38° C.) during the puerperium, though none were seriously ill. This includes fifteen with intrapartum fever, of which eleven had febrile puerperia. Warnekros assumed that fever during labor without bacteremia was due to the absorption of bacterial products from the infected placenta and consequently advised acceleration of delivery in the presence of intrapartum fever in order that time be not permitted for bacteria to penetrate the placenta into the maternal blood stream.

Intrapartum infection is reported to be even more serious for the child. Slemons<sup>9</sup> stated that the mortality has been variously estimated at 18 to 60 per cent. His material showed 40 per cent; and, although in many instances fetal death was due to some other abnormality, fetal bacteremia followed only syphilis and birth injury as a cause of death. Among the forty-eight children in this series associated with inflammation of the amnion and chorion, there were eight stillbirths or neonatal

deaths, 16.6 per cent. For four of these (under 1500 grams) unexplained premature delivery was the probable cause of death, and two others were premature and in addition were associated with severe toxemia. As noted before, there was no evidence of syphilis in this group. Death of the last two could best be explained clinically by bacteremia, though bacteria were found in only one of the placentas. The unimportance here of bacteremia as a cause of death might be only apparent because of the small number of cases; but it may be due, in part at least, to the employment of prompt delivery, when feasible, in the presence of intrauterine infection as evidenced by an intrapartum temperature elevation of 100° F. not due to intercurrent conditions. Certainly, such treatment seems indicated for the child's sake, as well as the mother's, by the histologic evidence of infection in fifteen out of seventeen febrile labors, as noted above. Unfortunately, in the majority of instances (thirty-three out of the forty-eight in this series) there is no temperature elevation, or at least not until the infection is well advanced, and no other reliable sign of intrapartum infection is yet known.

The study of the relationships of various conditions associated with inflammation of the amnion and chorion confirm, with the bacteriologic work of Harris and Brown,<sup>5</sup> clinical impressions as to some of the dangers of infection in cesarean section. For example, intrapartum fever not due to intercurrent infection was usually associated with histologic evidence of bacterial invasion of the uterus. With premature rupture of the membranes twenty-four hours or more before delivery, the incidence of inflammation of the amnion and chorion was over eight times that with rupture within six hours of delivery. Prolonged labor and vaginal examinations seemed to be of less, but still definite, importance. On the other hand, there were three cases with inflammation of the amnion and chorion without vaginal examination or any signs of infection, and in which the duration of labor was less than six hours and rupture of the membranes just preceded delivery. Such instances may explain unexpected infection following cesarean section and would seem to be additional reason against employment of the operation (at least the classical type) without sufficient reason, even under apparently good conditions.

#### SUMMARY

Inflammation of the amnion and chorion was found forty-eight times in one thousand consecutive placentas. Taken as an evidence of infection, its presence indicates that in nearly all cases of intrapartum fever (not due to intercurrent conditions) there has been entrance of bacteria into the uterus. On the other hand, the absence of temperature elevation does not mean that bacterial invasion has not occurred. Intrapartum infection is an indication for acceleration of delivery in the interests of both mother and child; but its presence, as indicated by inflammation of the amnion and chorion, may often be unsuspected in the absence of fever. The increased incidence of inflammation with prolonged labor, vaginal examinations, and espe-



cially premature rupture of the membranes confirms previous impressions as to the increased danger of cesarean section under such circumstances, regardless of the presence or not of fever.

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2970 WEST GRAND BOULEVARD.

## CARCINOMA OF THE BODY OF THE UTERUS

A REPORT OF CASES TREATED BETWEEN 1875 AND 1927 AT THE  
FREE HOSPITAL FOR WOMEN

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THE following study of 101 cases of carcinoma of the endometrium covers those patients operated upon at this clinic between October, 1875, and January, 1927. The diagnosis was made or confirmed by microscopic examination in 95 instances; the clinical descriptions of the other 6, all seen before 1900, left no doubt about the diagnosis. Two patients showed squamous-cell carcinoma of the body; the other 93 showed adenocarcinoma, and of these, 2 had also squamous carcinoma of the cervix. Ten patients, 9.9 per cent, gave a family history of malignancy.

Carcinoma of the fundus differs so widely from carcinoma of the cervix, especially in regard to prognosis and treatment, that these differences deserve particular emphasis. Statistics of the relative frequency of the two types vary. Koblanck<sup>1</sup> found fundus carcinoma to be only one-tenth as frequent, while Mahle,<sup>2</sup> in a series of 855 cases at the Mayo Clinic, found 30 per cent in the body and 70 per cent in the cervix, or a ratio of 1 to 3.4. Of the 649 cases of uterine carcinoma admitted to this clinic between 1875 and 1927 there were 550 cervical carcinomas and 101 body carcinomas, or a ratio of 1 to 4.46. In this connection it is interesting to note that between 1902 and 1927 pathologic examination of specimens from private patients treated by members of the hospital staff revealed 108 cervical carcinomas and 97 carcinomas of the body, a ratio of 1.11 to 1. This greater proportion of carcinoma of the body in private practice has been emphasized before.<sup>4</sup>

A history of never having been pregnant was given by 37 patients, 36.6 per cent, of whom 16 were married and 21 single. Since the percentage of sterility among married women in general is probably between 10 and 16 per cent, it would appear that carcinoma of the fundus is uninfluenced by child-bearing<sup>7</sup> and somewhat more prevalent among the nulliparous.<sup>4, 5, 6</sup>

The average age of this group at the time of operation was 54.1 years. There were 4 patients between the ages of thirty-three and forty, 8 between forty and forty-five, 14 between forty-five and fifty, 28 between fifty and fifty-five, 21 between fifty-five and sixty, and 26 between sixty and seventy-two.

#### SYMPTOMS

Flowing after the menopause was the chief objective symptom in 74 instances, 73.2 per cent, and abnormal flowing was a symptom in 100 instances, either alone or associated with a discharge or pain or both. The earliest symptom was bleeding or bloody discharge in over 80 per cent of the cases. Most writers agree that this is usually preceded by a serous or mucous discharge.<sup>3</sup> In the majority of cases, however, it is the appearance of blood that brings the patient to the hospital. Discharge, usually of watery character, and pain were the next commonest symptoms. The pain usually complained of was sacral backache and a dull aching in either lower abdominal quadrant. In comparing the outcome of cases having various types of pain no general rule as to the prognostic value of this symptom could be formulated. It occurred about as often among those free from recurrence as in those who died from carcinoma. Loss of weight and anemia were relatively infrequent symptoms and are less noticeable in this than in most types of malignant diseases. The average duration of symptoms before operation was 1.9 years. In a similar series of 29 private cases (from the practice of Dr. Graves) the average duration of symptoms was 1.5 years.

#### ASSOCIATED PATHOLOGY

In 26 cases, 25.7 per cent, fibromyomas were found with the carcinoma. Two patients had squamous-cell carcinoma of the cervix as well as adenocarcinoma of the fundus. One patient showed a rapidly growing sarcoma (probably leiomyosarcoma—Dr. Mallory) in the remains of a cervix following hysterectomy for adenocarcinoma with coring out of the cervix. Two patients showed papillary adenocarcinoma of the ovary along with, and apparently distinct from, their endometrial carcinoma. Another patient had bilateral ovarian papillary serous cystadenomas. Lower genital tract pathology was found associated with the uterine carcinoma in 41 cases. Twelve showed a cervical polyp and 2 gave a history of having had one or two polyps excised.

Cervical atresia or stenosis, vaginal atresia or stenosis, senile vaginitis, marked vaginal or cervical atrophy, tight introitus, scarring in vaginal vault, or kraurosis vulvae were terms found singly or associated in this group.

#### GROWTH CHARACTERISTICS

The growth and extension of the disease as compared with carcinoma of the cervix is slow. It remains confined within the uterine wall until a late stage and rarely involves the parametria except by direct extension. Baisch<sup>8</sup> found the regional nodes involved in only 4 out of 24 cases. Cullen<sup>9</sup> regularly found the nodes free. On the other hand the tubes, ovaries, or pelvic peritoneum may be involved relatively early by metastasis through the tubal lumina by the blood stream<sup>17</sup> or by the lymphatics.<sup>18</sup> Thus the dissemination of the disease may occur by direct extension through the wall of the uterus and be followed perhaps by peritoneal implantation metastases, by direct extension to the parametria, rarely metastatic, by metastatic involvement of the regional lymph nodes occurring late in the disease and by metastases through the lumen of the tubes,<sup>14</sup> the blood vessels, or the lymphatics.

These characteristics of growth were well shown by the present series. There were 20 cases with metastases to parts other than the parametrium and broad ligaments. In 4 of these there were general peritoneal and omental metastases. The omentum was a locus of metastasis in 2 cases, the liver in 1, the "spine" in 1, the tube in 3, the cervix in 1, the vagina in 1, and the vulva in 1. The ovary or ovaries showed carcinoma present on microscopic examination in 8 cases. The type of growth in the ovary was in every instance identical with the primary growth. As the primary growth had not broken through the uterus in any case, the ovarian metastasis could have occurred only by way of the lymphatics or blood vessels or through the tubal lumen. In 2 of these cases free particles of cancer were found in the outer third of the tubal lumen. A series of 39 private cases of carcinoma of the fundus operated on at this hospital were also studied. The ovaries or tubes showed metastasis in 9 cases. In one case the tube was involved by direct extension through the lumen; in the other cases the growths were apparently metastatic, with the possible exception of one where the disease had broken through the uterine serosa. One case showed an endometrial adenoma in the opposite tube and ovary, thus illustrating the possible metastasis of both a benign and malignant implant in the same patient.<sup>14</sup>

#### PATHOLOGIC CLASSIFICATION

An attempt was made to classify 53 cases of this series according to microscopic pathology (by Dr. Grinnell). The classification of Ewing<sup>1</sup> was used:

<i>Type</i>	<i>Cases</i>	<i>Per Cent</i>
Malignant adenoma	39	73.9
Papillary adenocarcinoma	10	18.9
Alveolar carcinoma	3	5.4
Squamous carcinoma	1	1.8

The malignant adenomas proved to be most common. These are thought to owe their origin to the endometrial glands while the papillary adenocarcinomas are believed to arise from the superficial endometrial epithelium. The alveolar carcinomata are rare and are composed of small solid masses of cells forming occasional small alveoli. According to Ewing these are more malignant than the adenomas. They may perhaps represent a less differentiated and more malignant type of adenoma.

An attempt was also made to grade these 53 growths according to their malignancy as indicated by the histology. This was worked out by Mahle<sup>3</sup> in a series of 186 cases at the Mayo Clinic. He used MacCarty's standard of cellular differentiation and its modification later adopted by Broders. Both are based on the degree of differentiation of the individual cell. In his series the postoperative results were shown to vary in direct proportion to the malignancy of each group. In the present series Broder's classification was used.

<i>Grade</i>	<i>Cases</i>	<i>Per Cent</i>
I (least malignant)	2	3.8
II	33	62.3
III	17	32.1
IV (most malignant)	1	1.8

Of the 50 growths classed under Grades II and III, 36 were malignant adenomas, 10 were papillary adenocarcinomas, 3 were alveolar carcinomas, and 1 was squamous carcinoma. Of Grade II, 60.8 per cent had no recurrence as against 33.4 per cent of Grade III. Also the duration of life after operation of those patients with recurrence was found to be shorter in the more malignant grades.

#### GROSS STATISTICS

Three patients received no treatment, the disease having been found too far advanced at exploratory celiotomy.

There were 3 operative deaths.

Another death was in the case of a patient whose complaint was an "abdominal rupture" (umbilical hernia) and in whom carcinoma was found on routine microscopic examination of tissues removed during a reconstructive operation, the patient having received no treatment for the carcinoma.

Untraceable (these are included in the calculations)-----	16
Died one year or less P.O., of cancer-----	11
Died one year or less P.O., without evidence of cancer-----	2
Died one to two years P.O., of cancer-----	6
Died two to three years P.O., of cancer-----	3
Died three to four years P.O., of cancer-----	1
Died four to five years P.O., of cancer-----	1
Died five to six years P.O., of cancer-----	2
Died seven to eight years P.O., of cancer-----	2

It would seem from these figures that a patient must live at least eight years after operation to be considered a cure, although only 4 patients of this whole group died of carcinoma after the five-year interval.

Living, with recurrence one year or less P.O. -----	1
Living, with recurrence one to two years P.O. -----	3
Living, with recurrence two to three years P.O. -----	2
Living, with recurrence three to four years P.O. -----	1
Living and well one year or less P.O. -----	4
Living and well one to two years P.O. -----	6
Living and well two to three years P.O. -----	2
Living and well three to four years P.O. -----	4
Living and well four to five years P.O. -----	5
Living and well six to seven years P.O. -----	3
Living and well seven to eight years P.O. -----	6
Living and well or died without evidence of cancer eight or more years P.O. -----	16

Passed the three-year interval, 41, or 42.2 per cent of the 97 who were treated. (Figuring to January, 1924, instead of to January, 1927, 56.9 per cent.)

Passed the five-year interval, 29, or 29.8 per cent (figuring to January, 1922, 43.9 per cent).

These figures are low, for it is reasonably certain that all of the 16 untraceable patients could not have succumbed before passing the three- or five-year interval. Despite this handicap there were 22 patients who passed the seven-year interval, thus placing the absolute curability in this series of at least 20 per cent as against a meager 5 per cent for carcinoma of the cervix.

#### DETAILED STATISTICS

Of the 7 patients treated only by curettage 2 are untraced, 2 died at five months, postoperative, 2 were alive with a recurrence at one year, postoperative, and 1 was alive with recurrence at two years eight months, postoperative.

Of the 4 treated by vaginal hysterectomy 1 was an operative death, 1 died of carcinoma at one year, three months, postoperative, 1 was alive with a recurrence at two years, postoperative, and 1 was living and well at twenty-one years, eight months, postoperative.

Of the 41 treated by radical hysterectomy 9 are untraced, 2 were operative deaths, 4.8 per cent; 2 died less than one year, postoperative, 2 from one to two years, postoperative, 2 from two to three years, 2 from five to six years, and 1 from seven to eight years, postoperative, all of carcinoma. Two died without evidence of carcinoma eight to nine years, postoperative. Three recent cases are alive and well less than one year, postoperative. One was alive and well one to two years, postoperative, 2 from two to three years, 2 from three to four years, 2 from four to five years, 2 from six to seven years, 2 from seven to eight years, 1 from eight to nine years, 1 from nine to ten, 2 from ten to eleven, and 1 from sixteen to seventeen years, postoperative. Thus 18 patients survived the three-year interval and 14 the five-year interval. Calculating to January, 1924, instead of 1927, gives a total of 33 cases in this group with 1 operative death and 54.5 per cent of three-year survivors. Similarly, calculating to January, 1922, instead of 1927, gives a total of 31 cases with 1 operative death and 45.1 per cent of five-year survivors.

Supravaginal hysterectomy was the procedure with 25 patients. There were no operative deaths. Three are untraced. Two died less than one year, postoperative, of carcinoma, 1 at one year, 1 at one year, eight months, 1 at three years, one month, and 1 at seven years, ten months, postoperative, of carcinoma. Two died ten to twelve years, postoperative, without carcinoma. One was well nine months postoperative, 2 between one and two years, 2 between three and four years, 1 at four years, five months, 2 between seven and eight years, 3 between eight and nine years, 1 at ten, 1 at twelve, and 1 at twenty years, postoperative. Fifteen or 68.1 per cent passed the three-year interval and 11 or 61.1 per cent passed the five-year interval, results being computed up to January, 1924, and January, 1922, respectively.

Four patients were treated by supravaginal hysterectomy followed by radium. Two are untraceable. One is alive with a recurrence three years, two months, postoperative (radium 50 mg. for ten hours), and 1 at one year, ten months, postoperative (100 mg. for twenty-four hours). Another patient, treated by complete hysterectomy followed by radium (200 mg. for twelve hours and 25 mg. for eight hours), died four years, one month, after hysterectomy. Still another patient, having first a supravaginal hysterectomy for carcinoma and fibroids, then a radical excision of the cervical stump and finally radium (200 mg. for twelve hours), is alive and well four years, seven months, after hysterectomy.

Radium followed by hysterectomy was the procedure with 5 patients. Three had radium: (1) 200 mg. for twenty-four hours, (2) 100 for twenty-four hours and (3) 100 for twelve, all followed by supravaginal hysterectomy. The first died at seven months after radium; the other 2 are alive and well at seven years, six months,

postoperative. Radium followed by radical hysterectomy was the treatment of 2 patients; 1 is alive and well at one year, four months, postoperative (radium 25 mg. for twenty-four hours) and the other is alive and well at six years, one month, postoperative (radium 50 mg. for twelve hours).

Nine patients were treated by radium alone. One patient could not be traced; she had metastatic breast carcinoma at the time of treatment. One patient, aged seventy-two, died of cerebral hemorrhage three months, postoperative. Two patients died of carcinoma ten months later (one was operable at time of treatment and one was a diabetic with a blood pressure of 240/160), 1 at one year, three months (operable) and 1 at two years, nine months later. One was living with a recurrence nine months, postoperative. One patient is alive and well one year, postoperative, at the age of seventy-one and with diabetes, and one at four years, nine months, after 3 doses of radium (100 mg. for twenty-four hours, 100 for twelve, and 100 for twelve), having been operable at time of first treatment. The use of radium in carcinoma of the fundus does not seem indicated except as a palliative procedure or where operation is definitely contraindicated. The location of the growth is such as to make it peculiarly favorable for surgery. Furthermore, radium has a less destructive effect on this type of carcinoma.

#### PROGNOSIS

The far better prognosis of carcinoma of the fundus as compared with carcinoma of the cervix is due chiefly to the following factors: late involvement of surrounding structures, infrequency of metastases, and lower degree of malignancy.

#### SUMMARY AND CONCLUSIONS

1. The ratio of carcinoma of the fundus to carcinoma of the cervix at the Free Hospital for Women, over a period of fifty-one years, was 1 to 4.46. The ratio in the private practice of staff members over a period of twenty-five years was 1 to 1.11.

2. Ten patients, 9.9 per cent of the entire group, 101, gave a family history of malignancy.

3. A history of never having been pregnant was given by 36.6 per cent of the patients.

4. The onset of symptoms occurred in most cases in the sixth decade and after the menopause.

5. Symptoms of the disease were present in most cases for nearly two years before the patient came to the hospital for treatment.

6. Bleeding or bloody discharge was the earliest and most prominent symptom.

7. Fibromyomas were also present in 25.7 per cent of the cases.
  8. Associated lower genital tract pathology, in some cases the cause and in others the result of poor drainage from the uterus or vagina, was found in 41 patients.
  9. The pathology of this disease has been discussed and compared with the findings in this series.
  10. The operative mortality was 3.37 per cent.
  11. Detailed follow-up statistics have been included.
  12. An absolute curability of about 20 per cent is approximately correct for this series as against 5 per cent for carcinoma of the cervix.
  13. In the less advanced cases on whom supravaginal hysterectomy was performed, 61.1 per cent passed the five-year interval. Account should be taken of the fact that early fundus carcinoma was an unexpected finding in a number of patients who had had supravaginal hysterectomy for fibroids and flowing, preliminary dilatation and curettage having been deemed unnecessary.
  14. The use of radium is not indicated in carcinoma of the body except as a palliative procedure when operation is contraindicated or when operation has failed to extirpate the disease completely.
- The following conclusions were reached after a special study of 53 cases:
15. The uterus was not enlarged in one-third of the cases in which gross specimens were obtained.
  16. Good results on probable "cures" were much more frequent in the less malignant cases graded according to their cellular differentiation.
  17. The postoperative life of patients dying from the disease was considerably longer among the less malignant grades.

We wish to express our thanks to Dr. W. P. Graves for the privilege of reporting his cases and for helpful suggestions. We also wish to thank Miss Isabelle C. Manson, Miss D. I. MacCormick, and Miss S. Danziger for much valuable assistance.

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# SUBACUTE BACTERIAL ENDOCARDITIS OF STREPTOCOCCUS VIRIDANS TYPE IN PREGNANCY, WITH TWO CASE REPORTS

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MEDICAL literature is replete with articles dealing with subacute bacterial endocarditis both from the clinical and bacteriologic viewpoints. As a complication of pregnancy, however, the scarcity of information concerning this disease entity is so noticeable that an account of two cases appearing within six months of each other in one hospital, should prove of interest.

MacKenzie<sup>30</sup> does not mention the disease as complicating pregnancy and DeLee<sup>29</sup> and Williams<sup>28</sup> pass over it very lightly. Osler<sup>6</sup> spoke of the possibility in his Galstonian lecture of 1885 and quoted one case from Guyot, two from Litten and one from Trueman. None of these cases can be truly identified as subacute bacterial endocarditis but all were later quoted by Croom<sup>3</sup> who reported one of his own and one from Kelynaek, both of which were doubtless malignant endocarditis. Webster<sup>23</sup> did not mention subacute endocarditis in his article and Norton<sup>14</sup> reported two cases of "infective endocarditis" during pregnancy which were merely streptococcic septicemias resulting from attempts at criminal abortion. French in 1908 did not discuss the condition and Horder of St. Bart's had never seen a case.

The only definitely positive case found was the case reported by Findley<sup>10</sup> in which the causative organism was isolated, the uterus emptied by incising the cervix, the patient dying two weeks after delivery from the kidney effects. All of the cases from the French literature reported by LeGendre,<sup>13</sup> Milian,<sup>12</sup> Combemale<sup>11</sup> and Arloing<sup>7</sup> are atypical, while Ryder<sup>2</sup> found no case in 9000 confinements at the Sloane Maternity Hospital.

Newell<sup>27</sup> and Murray<sup>18</sup> did not discuss the complication and Blumer<sup>16</sup> in a paper on subacute endocarditis with over 200 references does not speak of it as a complication of pregnancy.

Cameron<sup>5</sup> believed the sources of infection were three in number: (1) as a result of influenza; (2) from the intestinal tract; (3) from pyorrhea. He quoted Vinay as saying that the condition is very rare in pregnancy and mentions Jaccoud's case of "gestational infective endocarditis," which probably was secondary to syphilis. Behrens<sup>17</sup> gave as the reason for the increase in the incidence of the disease in females over males in the third and fourth decades, the association with abortion and puerperal sepsis. Libman<sup>15</sup> in analyzing 800 cases

of subacute endocarditis does not mention it as complicating pregnancy and groups all cases arbitrarily according to clinical picture and laboratory findings.

It is quite generally conceded that almost all cases begin on the foundation of an old sclerotic rheumatic heart and Osler said only too truly that "many lives might be saved if the sufferers from chronic rheumatic valvular defects could receive some protective inoculation against the *Streptococcus viridans*."

In the discussion of means of entrance into the blood stream there is not such a wide agreement. Blumer put teeth, tonsils, female generative organs and wounds in that order of importance as places of entry, his genital cases being mostly postpartum. Out of 330 cases he found antecedent rheumatism in 140.

In the laboratory findings we find nothing remarkable in the white blood count as Behrens reported an average of 12,000-15,000 with nothing diagnostic in the differential ratios. Urine examination in all cases sooner or later shows the presence of kidney damage with signs of embolic phenomena, blood in the urine, albumen, etc.

Blood examinations may have to be repeated several times before a positive culture is obtainable. Kinsella<sup>22</sup> said that while the bacteria obtained are almost always streptococci, other organisms such as influenza bacilli and gram negative cocci have been described. Rosenow claimed that bacteria isolated from these cases are usually modified pneumococci and tried to show that the continuation of infection and death were largely due to a process of bacterial immunization against the host rather than to the virulence, in the usual sense, of the infecting organism. Libman believed that 95 per cent were caused by *Streptococcus viridans* and 5 per cent by the influenza bacillus and said that positive cultures should be obtained in 70 per cent of cases. Blumer reported 304 cases, isolating a streptococcus in 248 cases and identifying it as the viridans type in 169 of those.

CASE 1.—Mrs. S. L. Age 23. Normal delivery of full-term baby, June 12, 1925, at Henry Ford Hospital with normal, afebrile puerperium.

Other events in past history peculiarly associated with present illness, were a mild attack of chorea at the age of 8 and a mild attack of rheumatism at the age of 10, not severe enough to confine to bed, ankles mostly being involved. Tonsils were removed in 1922 because of choking spells, a surgeon saying they were badly diseased. Numerous teeth have been devitalized at various times but were not x-rayed prior to admission. In spite of these etiologic factors there never had been any symptoms referable to the heart. She went through the first pregnancy without evident decompensation. The heart was not found enlarged although a faint systolic murmur was heard at the time of registration.

For six weeks prior to admission to the hospital on June 15, 1926, in the sixth and seventh lunar months of her second pregnancy, she had been having symptoms unlike any experienced during the first pregnancy. Anorexia, generalized headaches, insomnia, mental slowing, night sweats, unproductive cough and numbness in various

extremities were cited. On June 14, small, tender spots were noticed on the tips of the two middle fingers of the right hand. This prompted the admission to the hospital the next day.

*Examination June 15, 1926:* (Positive physical findings only.) Evident psychomotor retardation. Petechia in the end of the right middle finger and third finger with a fading spot in palm of left hand were noticed. Teeth: Small areas of radiolucency about the roots of the left upper first and second bicusps and the lower right first molar were seen by x-ray. These were devitalized. The upper left first molar, upper right second bicuspid, first and second molars, lower left first bicuspid and the lower right first bicuspid were also devitalized.

*Heart:* R.C.D. 11.5 by 3. First sound at apex ending in soft blowing systolic murmur well transmitted. No snap to first sound and no presystolic murmur. Accentuated pulmonic second. Sinus tachycardia present but no changes in E.K.G. were noted except large P-waves in lead 2. Pulse normal, B.P. 120/75.

*Abdomen:* Fundus enlarged to 8 cm. above umbilicus. Fetus, presenting by vertex, floating, with heart in LLQ.

#### COURSE IN HOSPITAL

*Blood Cultures:* Streptococcus viridans isolated on four different occasions.

*Blood Counts:*

	H.B.	R.B.C.	W.B.C.	P.M.N.
High	63%	3,666,000	13,680	86%
Low	50%	2,840,000	8,300	71%
Average	56%	3,159,000	10,650	78%

*Urinalyses.*—Sp. G. ranging from 1.012 to 1.024. Albumin one to two plus. No casts. Sugar negative repeatedly. Presence of blood proved on many occasions.

*Phthalein.*—45% and 47% on two different occasions.

*Blood Chemistry* (on admission).—N.P.N. 22.4. Urea N. 13.1. Uric Acid 2.87. Sugar 71.

*Embolic Phenomena.*—Third left toe early in June; tips of middle two fingers right hand on June 14; palm of hand June 15; tip of right little finger June 23; culture of Staphylococcus albus from pus; question of deep splenic infarct July 21; kidney infarcts present as shown by blood in urine.

*Treatment.*—Kept in bed continuously. Soft diet, with carminatives. Bowels markedly constipated, necessary to give enemas after admission, liquid petrolatum not being sufficient. General sedative necessary. It was necessary to give medinal and pyramidon at times and patient occasionally required codein. Sodium salicylate with sodium bicarbonate gr. v, t.i.d. p.c., Bland's mixture, augmented with iron arsenite and strychnine (h). Sodium cacodylate amp. i. q. alternate days. 50 c.c. 1/500 aqueous gentian violet given by vein on June 30. No reaction.

The upper left first and second bicusps and first molar were extracted on June 24. These showed Streptococcus viridans in culture. The lower left first and second bicusps were extracted on June 28. These cultures were contaminated.

*Labor and Puerperium.*—Labor pains started July 18 at 8:30 p.m. and a normal female infant was born spontaneously at 1:00 a.m., July 19. A first degree tear was repaired. Placenta grossly normal without infarcts. Blood from the umbilical cord showed Streptococcus viridans. Lochia was always extremely scant, requiring only one pad a day. Baby gained slowly but showed no evidence of generalized septicemia, no petechiae or fever and was discharged from the nursery as a normal infant at 8 weeks.

*General Course.*—The general course was characterized by remittent intermittent fever and tachycardia of an irregular type. General reactions of patient showed indifference, loss of fighting spirit, general weakness. Occasional arousal of her

interest occurred when a new embolic phenomenon occurred and at the time of labor. It was thought at times that there might be a systolic murmur to the right of the sternum in the second interspace, suggestive of tricuspid involvement. General course was slowly down-hill and the patient died of exhaustion August 20, 1926.

The blood culture from the cord taken at delivery showing a *Streptococcus viridans* might have been a contamination as a subsequent blood culture was negative and the baby gained nicely on a cow's milk formula. However, we feel that the culture of cord blood probably showed the presence of a bacteremia that disappeared spontaneously. Placental studies showed nothing abnormal, and special bacterial stains revealed no organisms present.

#### AUTOPSY

*External Appearance.*—The body is that of a markedly emaciated young white woman. The skin is fair and pale with numerous petechiae. The teeth are greatly neglected, only snags and stumps being left of molars and premolars.

The heart is somewhat larger than normal and its left half is proportionately bulkier and firmer. The right half is moderately distended. On opening the left heart, the mitral ring is of usual dimensions but is completely blocked by the presence of large fungoid vegetations all around. They are fairly firm and are not friable. The edges of the mitral valve are somewhat shorter and clumsier but pliable and free of sclerotic or calcareous changes. The myocardium is of fair thickness. It is rather soft and lusterless, with scattered, irregular, yellowish patches conspicuous in the pale red base.

The spleen is firmly adherent to the diaphragm all over except at its basal surface. Instrumental dissection is required to remove the spleen. It is larger than usual and more than half of the cut surface shows whitish, yellowish or reddish circumscribed areas. They are well defined and filled with semisolid necrotic material. Others are smaller, firm, less well defined, with evidences of absorption and cicatrization.

The kidneys are small, their fatty envelope scanty, the fibrous capsules stripping with difficulty. The parenchyma is pale, yellowish-pink and firm. The lower pole of right kidney is transformed into a firm whitish-gray mass. On cut section through this kidney, the parenchyma is pale and the pelvis and ureter somewhat distended. The firm area in the lower pole appears to be an older necrotic area that shows cicatrization. The left kidney shows numerous areas of whitish necrosis, all reaching the surface. They average 1 cm. in diameter, are well defined and rather firm.

The mucosa of the cervix is absent almost everywhere, the base of the cervix presenting an angry red, ragged surface covered with loose bloody débris. In the right half of the corpus and extending into the fundus there is attached to and infiltrating the wall, a fungoid bloody mass the size of a walnut that entirely fills the cavity. There are sinuses visible in it that are filled with blood. Small white areas of firm structure are seen on cut section.

Postmortem bacteriologic examination of the heart's blood showed *Streptococcus viridans* on culture.

*Anatomic Diagnosis.*—Subacute vegetative mitral endocarditis; multiple embolic infarcts of spleen and kidneys; petechial hemorrhages of skin and intestinal mucous membrane; subinvolution of the uterus; subacute hemorrhagic and necrotic endometritis and metritis; thrombosis of veins of the uterine plexus; acute parenchymatous and fatty degeneration of myocardium, liver and kidneys; acute fibrinopurulent bronchitis with bilateral bronchopneumonia; acute mesenteric and retroperitoneal lymphadenitis; chronic fibroadhesive perisplenitis; streptococcus septicemia.

CASE 2.—Mrs. D. Z., 24 years old, born in Germany, has lived in this country 3 years; had influenza in 1919.

Chief complaint, pain in back, abdomen and joints.

The patient's last menstrual period was May 23, 1926, making her expected date of confinement March 2, 1927. Three weeks ago she caught cold and has had a cough continuously since. Has also had pain in her chest over the precordium and mediastinum which radiates through to her back. There is a severe pain in the lower lumbar region and her knees are stiff and painful so that she walks with difficulty. Joints of fingers are stiff and painful. Pain over the lower abdomen is attributed to the fact that the baby is quite active. Patient believes that she has been having fever at night and has had several attacks of dizziness with spots before her eyes.

Examination December 14, 1926. Temperature 99.6°. Pulse 116. Respirations 22. Patient weighs 116½ pounds, rather small in stature, skin is warm and moist. Teeth, carious, with some infection of the gums. Heart, epigastric pulsation, PMI not localized, RCD not increased. Sounds are loud and forceful with a loud systolic murmur. B.P. 112/72. Abdomen, the fundus reaches to ½ of the distance between the umbilicus and xiphoid, fetal heart easily heard. BMR, plus 15 per cent.

X-rays show rather unusual hilus involvement but no lesion of the parenchyma. Some small red areas observed on the skin of the hands, wrist and face suggest either tiny angiomas or petechiae. The history of joint pains, loss of strength and fatigue suggest the necessity of a blood culture. Urine culture is negative.

#### COURSE IN HOSPITAL

*Blood Cultures.*—*Streptococcus viridans* isolated twice.

*Throat Culture.*—December 30, 1926. Nonhemolytic streptococcus predominating.

*Blood Counts:*

	H.B	R.B.C.	W.B.C.	P.M.N.
High	70%	3,712,000	13,300	86%
Low	49%	2,088,000	6,650	77%
Average	55%	2,764,000	9,690	83%

*Urinalyses.*—Sp. G. ranging from 1.004 to 1.030. No albumin present until after delivery which was probably due to contamination of the lochia. Sugar present was identified as lactose.

*Embolic Phenomena.*—Thrombosis left radial artery Dec. 21; tips of index and middle fingers of left hand, Jan. 1; right middle and ring fingers, Jan. 15; severe pain in right knee joint; right foot, 1st, 2nd and 3rd toes, three large red areas on ball of foot, Jan. 21; loss of vision, specks before eyes but no petechia or exudate seen in eye chambers, Feb. 4; swelling and discoloration of the terminal phalanges of the 2nd, 3rd, and 4th fingers of the right hand, Feb. 15.

*Treatment.*—Continuously in bed; transfusion 450 c.c. Jan. 8 and 500 c.c. Jan. 11. Eight intravenous injections of sodium cacodylate varying from 1½ to 4½ gr.

*Labor.*—Jan. 23 five weeks before term, lasting 5 hr. Spontaneous delivery with a 1st degree laceration not repaired. Infant weighed 1770 gm. and died on following day.

*General Course.*—The general course was characterized by intermittent fever and tachycardia of an irregular type. Patient was rather apathetic but usually remarked that she was getting better when asked how she felt. Systolic murmur at the apex had no identifying characteristics. Patient was discharged on Feb. 28 under the care of a private physician as the family felt that her entire condition was a result of venipuncture on Dec. 20; course stationary at discharge. Patient died at home several months later and autopsy was not obtained. Unfortunately the placenta in this case was lost and studies were not made.

## AUTOPSY OF BABY GIRL

*Head.*—The soft meninges are hyperemic and the superficial vessels markedly engorged. All over the convex surfaces of both cerebral hemispheres, especially over the posterior halves, many grayish-yellow irregular areas of necrosis are seen in the cortical matter which vary in size from 2 mm. to 12 mm. in size. On palpation, they are somewhat firmer than the unaffected cortex. The brain on palpation is fluctuant on both sides. On removal from cranium about 10 c.c. of watery clear liquid is lost in which minute whitish flakes of necrotic matter are contained. The basal surface of brain shows similar changes. In the cortex of the cerebellum only a thin, streaky, yellow discoloration is seen. On cut section, through the cerebral hemispheres the lateral ventricles are greatly distended, with a thin shell of cortical matter of 1 to 3 mm. thickness. The ventricles contain a great deal of liquid which contains flakes of disintegrating cerebral substance. The necrotic cortical areas, especially in the posterior half of the brain, are seen to penetrate the remaining cortical matter and to form small villous islands of softened, necrotic material. The anterior horns are much less distended. The third ventricle is also wider than normal.

*Bacteriology.*—Cultures made from spleen: No growth after 7 days. Cultures made from heart's blood: Nonhemolytic streptococcus.

*Anatomic Diagnosis.*—Multiple infarction of brain; internal hydrocephalus.

## DISCUSSION

Both of these cases are of the subacute endocarditis type that is caused by *Streptococcus viridans*. As a foundation for the active process, Case 1 had a typical history of a rheumatic heart while in Case 2, due to difficulties with the language, we were unable to obtain a concise history. However, Case 2 definitely had suffered from influenza seven years previous, to which some authors ascribe a causative influence. The portal of entry of the infection is obscure but the possibility of influenza in one and definite pyorrhea and dental pathology in both must be thought of if Cameron's ideas are to be held probable. The history of an antecedent infection with cardiac involvement, that became activated or reinfected during a period of lowered resistance during gestation, is a point to be considered in both cases. The disease in Case 1 ran its course in about fifteen weeks and in Case 2 in about twice as long. In both instances specific treatment gave no results.

Delivery in both cases did not seem to influence the course of the disease, either favorably or unfavorably. In Case 1 a full-term infant was delivered which showed a bacteremia resulting from transplacental infection but with an uneventful recovery. In Case 2 a premature infant was born that died seventeen hours later with very definite signs of intrauterine infection by placental transmission as the cause of death, the infecting organism being the same as that causing the disease process in the mother.

## CONCLUSIONS

1. Subacute bacterial endocarditis with *Streptococcus viridans* as the causative organism is rarely seen during pregnancy, but the prognosis is always grave.

2. Probably all cases have previously damaged hearts as a foundation for an activated process of a latent organism in an old focus of infection or a new infecting agent that gains entrance through an obscure channel.

3. We have as yet no specific measures in treatment. Supportive measures of any kind may be employed.

4. Therapeutic abortion is contraindicated as the course of the disease is not influenced by termination of the pregnancy and labor at full term does no damage to the mother, while the course of the disease runs long enough usually to allow the fetus to attain viability. Delivery does not seem to hasten a fatal outcome from either of the standpoints that would seem probable; namely, increasing the virulence of the infecting organism and opening up new avenues of infection through the uterus damaged in labor, or forcing an extra load on an already seriously damaged heart. Efficient hospital supervision during labor with delivery by low forceps at the end of the first stage, using any one of the "painless labor" anesthetics, is a proper procedure.

5. Cesarean section, strictly in the interests of a viable fetus in a mother who is failing rapidly near term, may be indicated.

6. Placental transmission of the causative organism resulting either in a simple bacteremia or a real septicemia in the child may usually be expected.

7. Death is due to exhaustion or emboli, and postmortem cesarean section, while usually futile, may be performed at the express wish of relatives.

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# THE INCREASE IN SUGAR METABOLISM PRODUCED BY THE OVARIAN HORMONE

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LOEWY and Richter<sup>1</sup> found that the removal of the ovaries decreased oxygen consumption and that the administration of dried ovaries to these castrates increased it. The object of this investigation was to determine the effect of the ovarian hormone on sugar metabolism.\*

In order to study the direct effect of these substances on sugar metabolism, the single celled animal, *paramecium caudatum*, was used. The hormone was added to the sugar solution containing the paramecia. Sugar determinations were made immediately and subsequently according to the method of Benedict, and in this way the direct effect of the substance on the rate of sugar utilization was determined. The sugar used was dextrose. The paramecia were grown on an infusion made of pond lily leaves, alfalfa, and lake water. They were collected and washed free of debris by means of a small centrifugalizing machine. The centrifugalizing tubes were graduated in c.c. so the paramecia were measured as they were collected.

The following is the description of a typical experiment with the ovarian hormone. Twenty-five c.c. of paramecia were collected and introduced into 500 c.c. of aerated lake water in which were dissolved 500 mg. of dextrose. This 500 c.c. paramecia-sugar preparation was divided, while being thoroughly mixed by pouring from one vessel to another, into five portions of 100 c.c. each. The 100 c.c. portions were introduced into sedimentation glasses, and air was bubbled through the liquid to insure an adequate supply of oxygen. To one portion 25 mg. of ovarian substance were added; to another 75 mg.; to another 100 mg.; to another 200 mg., while the remaining portion served for control. Sugar determinations were made immediately and at the end of twelve hours. The results of the determinations are shown in Fig. 1. It will be seen that the control used 41 per cent of the sugar in twelve hours; that the paramecia to which the 25 mg. of ovarian substance were added used 44 per cent of the sugar, that to which 75 mg. were added 70 per cent of the sugar, that to which 100 mg. were added 81 per cent and that to which 200 mg. of the ovarian substance were added used 75 per cent of the sugar. By comparing the effect of these different amounts of the ovarian substance on sugar utilization, it will be seen that 100 mg. produced the greatest increase in sugar utilization. The fact that 200 mg. produced less increase in sugar utilization than the 100 mg. is attributed to the so-called depressing or toxic action of the large dose. However, it should be stated that these paramecia showed no signs of injury so far as could be detected with the microscope. They swam around freely, and behaved in every way, so far as could be observed, like the controls.

\*The ovarian hormone used in this investigation was a Parke, Davis and Co. preparation. It is sold under the name of "ovarian substance" and one grain of the powder represents six grains of the fresh gland.



The question that arises in this connection is, will the results obtained with the single celled animal, paramecium, hold for a multicellular animal such as the mammal. We believe they will because paramecium uses dextrose and levulose more rapidly than galactose just as is the case with man, and insulin increases the rate of this utilization, again resembling man.<sup>2</sup> The increase in oxidation observed by Loewy and Richter after the administration of dried ovaries was, we believe, due to the stimulating effect of the ovarian substance on the oxidation of sugar just as is found to be the case with paramecium in this investigation. Another question that might be raised in this connection is, does the ovarian hormone normally play any rôle in sugar metabolism? The following are reasons for believing it does.

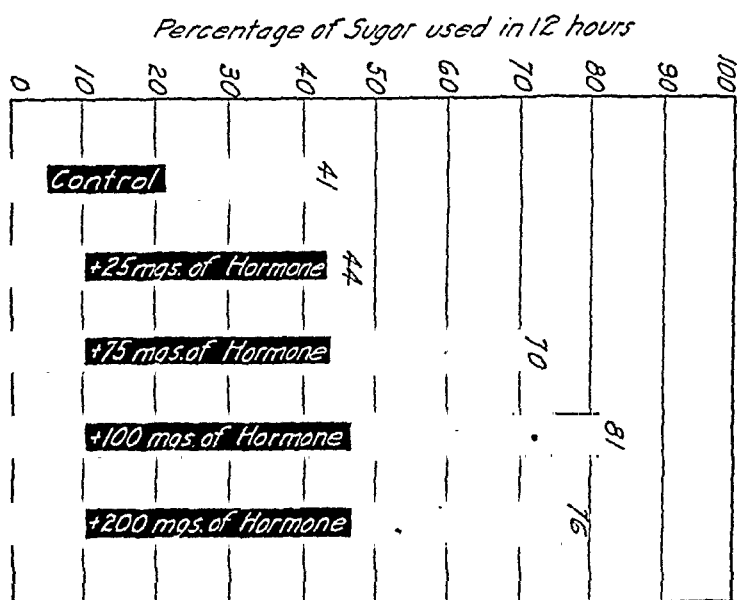


Fig. 1.—Chart showing that the ovarian hormone increases sugar utilization.

It is known that in women after the menopause, when the ovarian hormone ceases to be formed, or after the removal of the ovaries, there is a tendency to lay on fat. Since fat is formed from sugar, this tendency to lay on fat following the climacteric may be due to the decrease in this hormone with resulting impairment of the body to use sugar. According to this assumption the ovarian hormone supplements the action of insulin. Insulin as pointed out above increases the rate of sugar utilization by paramecium just as does the ovarian substance. It may be stated, therefore, that the ovarian hormone greatly increases sugar utilization.

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# POSTPARTUM ECLAMPSIA WITH DEATH FROM CEREBRAL HEMORRHAGE AND ENCEPHALOMALACIA LIMITED TO THE LEFT FRONTAL LOBE\*

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THE occurrence of cerebral hemorrhage and encephalomalacia, limited to the left frontal lobe in a patient after apparent clinical recovery from her eclampsia, is sufficiently rare to warrant recording.

CASE REPORT: Mrs. V. C., para iii, age thirty-two, white, Italian, admitted to Jersey City Hospital, 9 P.M., Oct. 19, 1926, with history of having been delivered of a live baby by her mother about 12 hours before, was seized immediately post-partum with an unknown number of typical eclamptic convulsions and intervening coma. After refusing her daughter medical attention on several occasions, the mother finally permitted her removal to the hospital.

On admission, patient comatose, almost moribund; temperature 99.4, pulse 140; respiration 36; blood pressure 178/100. Urine boiled solid with albumin; microscopically, many hyaline and granular casts, red blood cells, and a few white blood cells.

*Course and Treatment.*—During the first five hours, patient had eight convulsions despite three intravenous injections of magnesium sulphate 25 per cent, 10 c.c. doses, morphine  $\frac{1}{4}$  gr., phlebotomy (170 c.c. needle clotted), intravenous of 1000 c.c. glucose 5 per cent, with 12 units of insulin, rectal instillation of bromide and chloral hydrate and colonic irrigations. Eight hours later magnesium sulphate 25 per cent, 10 c.c. and morphine gr.  $\frac{1}{4}$ , were given again because of the occurrence of a convulsion. Patient's blood typed and blood transfusion of 600 c.c. preceded by phlebotomy of 500 c.c. given five hours following last convulsion, resulted in the cessation of convulsions. The patient apparently began to improve. Blood transfusion of 600 c.c. repeated nine hours later. High colonic irrigations every twelve hours, bromides and chloral rectally, repeated doses of morphine and hypodermoclysis of 10 per cent glucose and insulin, resulted in the apparent continued clinical improvement of the eclamptic condition. Patient came out of her coma, became rational and took nourishment readily. B.P. 150. On the evening of the fifth day, Oct. 23, patient began to act queerly. She was noisy and talkative, threw bedclothes off, tossed about in bed, screamed and refused all nourishment for twenty-four hours. Repeated doses of hyosine and an intravenous injection of magnesium sulphate were finally effective. At intervals during the next four days, she became unmanageable, talking, shouting, tossing about and refusing all nourishment. The evening of the tenth day, there were convulsive twitchings of the face, a rise in temperature to 104°, after which the patient became semicomatose with interval of lucidity. Fluids were supplied by repeated hypodermoclyses of 5 per cent glucose.

Prior to another transfusion of 300 c.c. given her on the 14th day, patient showed rigidity of the neck. She became cyanotic, markedly dyspneic, developed pulmonary edema and had occasional twitchings of the face. Her skin was cold

\*Read at a Meeting of the Section on Obstetrics and Gynecology, New York Academy of Medicine, November 22, 1927.

and clammy, and covered by a diffuse diaphoresis. At this time patient also complained of pain on being moved. Six hours prior to her death, patient had two convulsions, lasting about three minutes each.

The temperature from the onset was between 100 and 101 degrees until the tenth day postpartum, when it rose to 104.6°, remaining between this and 107.2° until death, sixteen days after labor, Nov. 3, 1926.

From the third day until her death patient voided involuntarily.

Lumbar puncture on the seventh and fourteenth days, elicited clear spinal fluid, under slight pressure.

Bronchopneumonia manifested itself on the tenth day.

Blood chemistry: Two readings normal, except for slightly lowered  $\text{CO}_2$ , 42 c.c. per 100 c.c. serum, on her admission.

Spinal fluid: 7 days postpartum, Oct. 26, clear, 8 cells per cm., globulin negative, sugar present. The day before death there was faint trace globulin. No cell count was done.

Examination of the fundi was later impossible because of the extreme restlessness of the patient.

Neurologic examination, negative.

Autopsy findings: Rigor mortis, absent. Skin, smooth and white. No abnormalities of the calvarium. Pupils, round but irregular. The left is dilated whereas the right pupil is contracted. Mouth, nose and ears, negative. Thyroid, not palpable. No superficial adenopathy.

Thorax: Heart and lungs are in relatively normal apposition. Both lungs adherent to lateral and posterior parietal pleura by fibrous adhesions, and have a doughy, puffy appearance in the upper two-thirds. They are of a gray and black mottled appearance. Both bases are deep red in color and on section show dark red granular areas. Heart is not enlarged and presents no excessive epicardial fat. Myocardium, pale and flabby. Auricular appendages appear normal. No valvular defects. Aorta, smooth and elastic throughout its course. Coronary orifices patent.

Upon opening the abdomen, no free fluid noted. Transverse colon and cecum dilated and viscera in normal apposition. The gastrointestinal tract shows no gross changes throughout its course. The liver is of average size, brownish color with whitish and yellowish streaks over the surface. On section the markings are prominent with yellowish and whitish streaks scattered throughout the parenchyma. Spleen slightly enlarged, grayish and somewhat mushy. On section the pulp is soft, rather homogeneous and of a deep red color. Pancreas shows no gross deviation. Adrenals show beginning postmortem autolysis. Kidneys are of average size and of a purplish red color, though the markings are fairly distinct. Bladder and ureters appear normal. The uterus extends midway between umbilicus and symphysis and is large and boggy. The wall is thickened and the inner surface is rough and sanguinous, but not putrid. Tubes and ovaries show no gross changes. On section, right ovary presents recent corpus luteum.

Brain.—The left cerebral hemisphere is more prominent than the right. The meninges are congested but present no thickening or exudate. The cranial nerves and circle of Willis are intact. Upon removal of the cerebrum the left frontal lobe is found to be soft and friable. There is a cavity in the left frontal lobe measuring approximately 3 x 5 cm. It is filled with a dirty reddish fluid. It involves the superior and middle frontal convolution, and extends backward almost to the precentral gyrus and downward partly into the inferior frontal convolution. There is no blood or blood stained fluid in the ventricles. The cerebellum and brain stem show no gross changes. The sinuses appear to be intact.

Microscopic note: Section of the cerebrum shows degenerative changes and areas of focal hemorrhage. There is also generalized edema and congestion.

Myocardium shows degenerative changes. Lungs show areas of pneumonia, congestion, and emphysema. Liver shows swelling and fraying of many of the polygonal cells. Spleen shows marked congestion. Kidneys show scattered hemorrhage and congestion throughout. The cells of both glomeruli and tubules are frayed and swollen.

Anatomic diagnosis: Brain: Encephalomalacia, focal hemorrhage, congestion and edema. Heart, liver, and kidneys: Acute parenchymatous degeneration.

Lungs: Bronchopneumonia. Congestion. Emphysema. Chronic fibrous pleurisy.

*Discussion.*—In reviewing this case, we are impressed by the fact that the convulsions ceased after phlebotomy and the first transfusion and that the patient definitely improved clinically of her eclamptic symptomatology. The repeated administration of glucose and insulin and colonic irrigations further enhanced her clinical improvement. When the patient presented her marked psychic picture, we were at a loss to explain it other than as a puerperal toxic psychosis. Repeated neurologic examinations at this time elicited no information. Perhaps, if we had been able to obtain fundi readings the cerebral lesion might have been suggested to us. Unfortunately this observation was denied us because of the extreme restlessness, talkativeness, raving and hysteria.

On the tenth day, the facial twitchings, dilated pupils, semicomatose condition, with intervals of lucidness, and later her cyanosis, dyspnea, and labored respiratory efforts might have been the symptoms of cerebral hemorrhage. Since we had found pulmonary involvement with edema, the respiratory picture was apparently satisfactorily explained. We did consider meningismus or a possible meningitis, especially when the rigidity of the neck developed, but with negative spinal fluid and the absence of Koenig or Babinski, we were more inclined to ascribe her cerebral symptoms to the meningismus resulting from her bronchopneumonia. The convulsions just prior to her death were thought to be due to edema of the brain, the spinal fluid eliciting no information.

The autopsy findings presented some interesting features. First, the liver presented far less pathology than we expected. Instead of the more commonly reported periportal thrombophlebitis, necrosis and focal hemorrhages, we found evidence of moderate hepatic degeneration, fraying swelling of polygonal cells, with no hemorrhage or necrosis or thrombophlebitis. Titus<sup>1</sup> and other observers found that the liver of the eclamptic patient who had been treated with glucose and insulin showed a definite lack of hepatic damage. The apparent clinical improvement of the eclamptic symptomatology and the liver findings on autopsy seem to concur with the findings of Titus and his coworkers.

Second, the location and the limitation of the cerebral lesion to the left frontal lobe is most unusual. There was no outward interruption of the continuity of the cerebral tissue. The marked hys-

teric manifestations were apparently due to the hemorrhage, first appearing in the anterior portion of the superior and middle convolutions of the frontal lobe and then extending backward toward the precentral gyrus and finally downward to involve part of the inferior convolution. This latter being manifested clinically by the incessant incoherent and unintelligible mutterings and jabbering. The twitchings of the face possibly meant a further increase of the hemorrhage and subsequent necrosis and pressure outward toward the cortex and backward into the region of the motor area. None of the larger branches of the anterior internal frontal artery supplying the superior and middle frontal gyri could be demonstrated as having been ruptured. Nor was there any gross or microscopic evidence of an embolus. The pathology was apparently due to the coalescing of multiple focal hemorrhages and necrotic areas. This is clearly demonstrated by the moth-eaten-like appearance of the lesion in the photographic plates submitted. There was no encapsulation of the lesion.

*Comments.*—A review of the literature at my disposal elicits no case report of eclampsia complicated by left frontal lobe hemorrhage and necrosis. A significant fact is revealed in that cerebral hemorrhage, whatever the location, as a complication of eclampsia, occurs most frequently in the primipara and between the ages of twenty-two and thirty-eight.<sup>2</sup> It may manifest itself in any month of pregnancy, though most of the cases reported are in the last trimester or at term. It may occur during, preceding or following labor.

Of the fourteen case reports, there were five of left hemiplegia with only one death, the recoveries being reported by Knight,<sup>8</sup> Barrett and Harger,<sup>3</sup> Cronin,<sup>3</sup> Partridge,<sup>3</sup> and the fatal case by Mondy.<sup>3</sup>

Carver and Fairbairn<sup>2</sup> report a case of hemorrhage into the pons varolii and quote other fatal case reports of Meyer-Wirtz, Magrier and Chevane, and Esch, involving the corpora striata with blood in the lateral, third and fourth ventricles. They<sup>2</sup> also quote Pfannenstiel's fatal case of hemorrhage into the left optic thalamus and ventricles. Welch<sup>3</sup> also records one with hemorrhage into the corpora striata and ventricles of fatal issue. Lobenstein<sup>5</sup> and Gannelt<sup>6</sup> each report fatal cases. Kosmak<sup>4</sup> reports fatal hemorrhage into base of brain or ventricles (no autopsy).

Schantal<sup>2, 9</sup> found 10 cases of cerebral hemorrhage in 90 autopsies of eclamptics; of these, 5 were apoplexia gravis and 6 apoplexia capillaris. Glockner<sup>2, 10</sup> noted 3 in 26; Teacher<sup>7</sup> 6 in 21; Schrieber<sup>2, 12</sup> four. Prutz<sup>13</sup> finds that 13 per cent of eclamptics show cerebral hemorrhage at autopsy. Schmorl<sup>11</sup> on the other hand reports that 58 out of 65 eclamptic autopsies show small, seldom large cerebral hemorrhages with areas of softening. He considers these of thrombotic origin and secondary to the convulsions.

*Summary.*—Eclamptic patients are more liable to cerebral hemorrhage than we were wont to believe and if autopsy always included examination of the brain we would probably find more cases that clinically had gone unrecognized. Large hemorrhage may occur any-

where in the brain, most commonly in the parietal lobe, corpora striata and ventricles and least frequently in the pons, optic thalamus, and frontal lobe.

Many small focal hemorrhages with surrounding areas of necrosis may form into one large hemorrhagic and necrotic area. This may be due to the solvent action of a circulating enzyme acting on the endothelial lining of the terminal blood vessels (Welch).<sup>4</sup>

Hemorrhage in the frontal lobe may give no clinical evidence other than hysteria and is confusing with puerperal toxic psychosis.

Blood transfusion, preceded by phlebotomy, given to eclamptic cases may arrest further extension of hemorrhage.

I wish to thank Dr. S. A. Cosgrove, attending obstetrician to the Jersey City Hospital, for his courtesy in permitting me to follow up and report this case. My appreciation is extended to the pathologist, Dr. Brownstein, for his complete report.

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422 BERGEN AVENUE.

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## ISCHEMIA OF THE PARTURIENT UTERUS

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**I**SCHEMIA of the parturient uterus, with resultant fetal asphyxia, is fortunately a condition not seen at the present day with the frequency that it was observed a generation or two ago. At that time, the discovery of ergot as an oxytocic was welcomed by those attending childbirth as almost a panacea for parturient troubles. It was consequently given indiscriminately by many physicians during labor, with the result that tetanic contraction of the uterus and its accompanying fetal asphyxia was not infrequently seen. The oft-repeated warnings by the writers of that day against the use of ergot during labor testify to this fact. With the relegation of the use of the drug to its proper place in the third stage of labor, the incidence of fetal death due to this condition has greatly diminished.

In our own day, with the advent of pituitrin as a therapeutic agent, much the same cycle has taken place. The fact that the injudicious use of this agent produced many cases of fetal asphyxia in the same

manner as its predecessor, has resulted in the limitation of the administration of pituitrin to and following the third stage of labor, when its value in the prophylaxis and treatment of postpartum hemorrhage is unquestioned.

The two cases here detailed show fetal asphyxia from circulatory interference of the parturient uterus, the cause of which in the one case is obscure, and in the other may be explained on purely mechanical grounds. These cases are reported, therefore, not only to again emphasize the importance of ischemia of the parturient uterus, but also to draw attention to the fact that this condition may be encountered when there has been no injudicious administration of ergot or pituitrin.

CASE 1.—White, para 1, age twenty-seven. Expected confinement December 27, 1925.

The patient has always been well—menstrual history negative. The inlet and outlet of the pelvis show normal measurements. A previous labor  $3\frac{1}{2}$  years ago was terminated after 18 hours by a version and extraction, because the fetal head failed to descend. The child weighed  $8\frac{3}{4}$  pounds. The present pregnancy was normal, with the exception that during the eighth month of pregnancy it was noted that the uterus was enlarged to the size of full term. On December 3, the patient was told that labor would occur somewhat earlier than the estimated date. She was seen on December 16 at 4 o'clock, and at this time said that she had experienced since noon severe contractions in the anterior portion of the abdomen, without marked pain. The abdomen was palpated during one of these contractions, and it seemed evident that labor was in progress. On her entrance to the New Haven Hospital, the uterine contractions recurred with great frequency, and lasted a very long time. There was scarcely any interval. They were so severe in character that the patient was taken to the delivery room, in order that a more thorough examination might be made. When examined in the delivery room, the uterine contractions were very strong, almost continuous, and seemed to "pyramid" to the upper anterior abdomen. These severe contractions were accompanied by only slight pain, a clinical picture which was, in my experience, unusual. Upon rectal examination, the cervix was found 3 cm. dilated, its edges thin, and the internal os obliterated. The vertex presented, the head was floating, and the position was R.O.T. The fetal heart was normal, r.l.q. Because of the unusually severe contractions, which seemed to expend their entire force in the upper abdomen, a tight abdominal binder was placed about the patient, in order, if possible, to direct some of its force toward the birth canal. The procedure, however, failed to bring about the desired effect. The almost continuous contractions continued, and at 12:30 A.M., December 17, the patient was examined by vagina. The os showed very little change—the previous diagnosis of vertex presenting, with floating head, was verified. During the contraction, it seemed that none of the uterine force was applied in the direction of the birth canal. In other words, even during a severe contraction, the head floated freely. The fetal heart at this time could not be elicited with certainty, and accordingly it was decided to terminate labor by version and extraction. The membranes were ruptured, and with the gush of fluid, a loop of cord was palpated just in front of the fetal head, which lay still high in the uterine cavity. It was evident that fetal asphyxia was present, for palpation of the cord showed a slowing of the fetal heart to about 60 per minute. The patient was anesthetized and a slow manual dilatation of the cervix accomplished—keeping the fetal head well above the superior strait out

of the birth canal, so as to eliminate any possible pressure upon the cord. At the completion of the dilatation, an easy version and extraction was performed. The child showed a severe asphyxia pallida, and although the fetal heart was still beating, respiration was in abeyance.

It is unquestionable that the asphyxia occurred in utero, but since there were no abnormalities of the umbilical cord, or compression during delivery, these complications were unrelated to the condition. I believe, therefore, that the fetal death depended upon uterine ischemia and interference with the placental circulation due to the unusually severe and continuous contractions during the first stage of labor. The mother made an uneventful recovery, and upon postpartum examination the uterus was in good position and well involuted. The cervix showed a slight superficial laceration, the peritoneum was relaxed, and the adnexa, with the exception of a slight thickening on the left side, were negative.

CASE 2.—White, American, age twenty, married eighteen months. There had been no serious illness. She had had an abortion at 4 to 6 weeks, which was completed by curettage. She was first seen in her second pregnancy on May 6, 1926. The menstrual history was normal. Expected date was July 2, 1927. Present pregnancy had progressed normally. The blood showed a negative Wassermann reaction. Physical examination showed a somewhat frail woman, in good health. The abdomen was thin-walled and quite pendulous. Duration of pregnancy was estimated to be eight and one-half months. Prior to her entrance to the hospital, she was seen at the prenatal clinic on four occasions, and at no time presented any symptoms of toxemia. On the last of these visits, the following note was made: The abdomen is very large—may be twin pregnancy. The patient was told some time ago that she had an ovarian cyst. This may account for the excessive size, if there is not a multiple pregnancy. Two hearts are not heard, neither are two heads clearly felt, although one rather small head is felt in the pelvis, and a possible second head in the fundus. The patient is unusually hard to examine. Because of this, the diagonal conjugate cannot be reached.

X-ray examination at the New Haven Hospital July 1 showed the presence of a single large fetus, vertex lightly engaged at the pelvic brim. Measurements of the pelvic inlet by x-ray showed anteroposterior diameter 10.5 cm., transverse 12.5, presenting part normal size.

The patient was admitted to the New Haven Hospital on July 4, 1927, at term, with vague labor pains. Examination showed the abdomen large, at term, protuberant, suggesting multiple pregnancy. The fetus was palpable in L.O.A., unengaged head, fetal heart in L.L.Q., normal. Rectal examination showed vertex presenting above spines, cervical canal almost obliterated, cervix dilated 3 cm., membranes unruptured. Pains of an indefinite character continued until the next morning, when at 6:00 A.M., one ounce of castor oil, with quinine sulphate grains 30, were given. Within an hour, pains became better established—at 3 to 4 minute intervals, 30 to 40 seconds duration—and at 8:00 A.M., examination showed the fetus in L.O.A., vertex slightly engaged, high, membranes unruptured, os dilated 2 cm., cervical canal obliterated, blood pressure 120/76. The pains following this examination became more indefinite, and continued in this manner throughout the day. At 7:00 P.M., the fetal heart was normal, cervix 3 cm. dilated, pains somewhat stronger. During the night, the condition remained about the same. Because of the normal size of the patient's pelvis, and her general condition, it was felt that normal labor would eventuate. She was therefore given morphine grains  $\frac{1}{4}$ , magnesium sulphate 2 c.c., 50 per cent solution, by hypodermic injection. She had a comfortable night following this medication. She was seen the next morning at 9:00 A.M. Pains were strong—every 2 to 3 minutes (had been so since 6:00 A.M.). Cervix was 3 cm. dilated, membranes unruptured. During each pain a



definite tumor mass could be felt in the left lower flank, just above the brim of the pelvis. The fetal heart could not be heard, and intrauterine fetal death was suspected. Vaginal examination showed the cervix to be dilated 3 cm., the canal obliterated. The lower uterine segment seemed to be pushed over to the right, so that the cervical opening was close to the left pelvic wall. In the left flank, just above the pelvic brim, was a firm, rounded mass, approximately 10 cm. in diameter. The picture suggested that this left-sided mass was interfering with the dilatation of the cervical canal and the engagement of the fetal head. The membranes were unruptured, and the fetal heart had not been heard that morning. The patient's general condition was satisfactory. Two possibilities offered themselves: First, the insertion of a bag, followed by an attempt at vaginal delivery; second, abdominal section. Considering the findings—the possibility of a difficult vaginal delivery, the uncertainty of the fetal heart, and the character of the left-sided mass—abdominal section seemed to be indicated. Accordingly, the patient was prepared for this operation. At operation the uterus was found to be twisted on its own axis to the left 90°, so that the right broad ligament and ovary presented themselves in the midline. The veins of the right broad ligament were enormously dilated. Palpation of the left lower flank revealed a large myoma contiguous with the uterine wall. Before incising the uterus, this organ was rotated manually to the right into its normal position at term, and the myomatous mass then rested over the symphysis in the midline. When this was accomplished, the greatly dilated veins of the broad ligament resumed a normal appearance, which suggested that the twisting of the uterus during labor had caused a considerable interference with the uterine circulation. An incision was made in the uterine wall above the myoma, and a moderately large, stillborn child was extracted without difficulty. The question of the removal of the myoma was considered, but the patient's condition did not warrant further abdominal procedure—the blood pressure having fallen to 78 mm. The patient was given glucose solution by hypodermoclysis. On incising the uterus, the ischemic appearance of the uterine wall was particularly marked—the uterine muscle having a pinkish color, rather than the usual bloody appearance. There was practically no blood lost. It was remarked by those in attendance at the operation that there seemed to be very much less blood present than had been seen in previous cesarean sections. The patient convalesced in a normal manner, and left the hospital at the end of three weeks.

*Comment:* It seems reasonable to believe that anything which interferes with the circulation of the uterus may produce ischemia at the placental site, with resulting fetal asphyxia. In Case 2 this seems evident, because the fetal heart was heard normally, without difficulty, up until the time when the tumor was first noticed in the left lower flank and the uterine torsion had taken place. From the time this occurred, no fetal heart was heard. In this case, it seems reasonable to believe, therefore, that the asphyxia was of a more or less rapid production. It seems reasonable to conjecture that when regular contractions of the uterus became established, the attempt to push the fetal head through the brim of the pelvis caused the displacement of the myomatous mass, and thus twisted the uterus on its axis to 90°. When this occurred, the circulation of the uterus was so interfered with that ischemia at the placental site took place, with the resultant fetal asphyxia.

A study of these cases draws our attention further to the fact that the lesser grades of asphyxia occasionally seen may be due to a less severe ischemia of the parturient uterus than is portrayed here. It seems reasonable to believe that long labors, and excessive uterine contractions in the first stage of labor (not due to drugs) or marked torsion of the parturient uterus, may so interfere with the placentouterine circulation as to cause severe, and even fatal, asphyxia of the fetus.

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## TREATMENT OF IMPETIGO CONTAGIOSA WITH GENTIAN VIOLET

BY HALL G. HOLDER, A.B., M.D., SAN DIEGO, CALIF.

*(From the Obstetrical Service of the Jersey City Hospital)*

**I**MPETIGO contagiosa neonatorum, a contagious disease of the skin in the newborn, presents a serious problem in maternity hospitals. Its ease of transmission and, at times, its high mortality makes this condition particularly dreaded. Reports from all parts of this country and, in fact, the world, indicate the pandemic nature of this infection.

The knowledge of the etiology being limited to the finding of the *Staphylococcus aureus* in strains of varying pathogenicity, the treatment of the disease has been largely prophylactic and by local anti-septic procedures.

On a service at the Jersey City Hospital, 115 cases developed from March, 1925, to January, 1927. Of this number 113 represented the milder form with no constitutional reaction. Two cases were of the exfoliative type; in one nearly two-thirds of the body surface was continuously affected and in the other about one half. Curiously enough there was little or no temperature reaction or toxic manifestation in either case although the severer of the two cried continuously before treatment was instituted. In this series one of four methods was employed as follows: (1) tincture of iodine, 3 per cent solution in 25.2 per cent of cases; (2) ammoniated mercury ointment, 10 per cent in 18.2 per cent of cases; (3) mercurochrome, 1 per cent aqueous solution in 5.2 per cent of cases, and (4) gentian violet, 2 per cent aqueous solution in 51.3 per cent of cases. In each case the vesicle was surrounded by the agent used and ruptured under aseptic precautions. The exfoliated epidermis was then removed and direct application of the respective preparation made. This latter point of technic is essential to permit proper contact at the site of infection. Efficiency of the respective substances is rated in the following order: (1) gentian violet, (2) mercurochrome, (3) iodine and (4) am-

moniated mercury ointment. Mercurochrome was satisfactory but did not produce as rapid delimitation and eradication of the infection as did gentian violet. Iodine also was effective but frequently was too irritating for the delicate infant's skin and less effective than gentian violet. The use of ammoniated mercury ointment, contrary to previous popular opinion, was found to be detrimental to rapid healing. Widening of the denuded base of the vesicle was observed under the greasy film, the mercury apparently having slight therapeutic effect. In addition the fatty base definitely delayed drying up of the lesion, leaving a spreading raw weeping surface prone to secondary infection. Compared to the other measures ammoniated mercury ointment is not only ineffective but prolongs infection and invites complications.

The use of gentian violet was suggested by the work of Churchman,<sup>3, 4, 5, 6, 7</sup> in which he shows that this dye, triphenyl methane, had a selective bacteriostatic action on gram-positive organisms, penetrating other organisms and living cells without deleterious effect. He found that gentian violet in 1:1,000,000 dilution inhibited the growth of staphylococci. As infantile impetigo is accredited to a strain of *Staphylococcus aureus*, it was decided to put this information to a clinical test.

Search of the literature reveals only one report of the treatment of impetigo with aqueous gentian violet solution. Smith and Burky<sup>11</sup> record 9 cases successfully treated with a 5 per cent aqueous solution. In our series of 59 cases 2 per cent aqueous solution was used. Application to the denuded base was made after preliminary circumvention of the vesicle or affected area and aseptic rupture of the vesicle with removal of the devitalized epidermis. The two severe exfoliative cases had contracted impetigo after discharge and were readmitted in a neglected state. The more severe of the two was aggravated by the application of ammoniated mercury ointment, prior to admission. Complicating secondary infection of the denuded surface was present. In both cases wide application of the dye was made, including the denuded areas. Reapplication, once a day for three successive days, was made in spite of the fact that there was no extension or recurrences. Noticeable improvement occurred in twelve hours and both cases were entirely healed in a week's time. Regardless of the extent of the lesion more than one application of gentian violet is seldom necessary, there being an immediate arrest of extension. Dessication is rapid and the thin crust formed permits of epithelization under the surface with the normal desquamation of this crust in about forty-eight hours. There was a notable lack of recurrence of lesions in individual cases so treated. Not until the use of gentian violet was instituted were we able to make noticeable headway in control of the epidemic so as, late in December, 1926, virtually to accomplish its

eradication. On discharge all mothers were instructed to return in case of reappearance of the lesion. Only four presented themselves, the babies showing minor recurrences.

I wish to express my appreciation to Dr. Samuel A. Cosgrove for his courtesy in affording me the opportunity of reporting the above cases.

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1301 MEDICO-DENTAL BUILDING.

## A CASE OF INTRALIGAMENTOUS PREGNANCY AT FULL TERM\*

By M. O. MAGID, M.D., NEW YORK, N. Y.

THIS case is of particular interest, since it again illustrates the theory I advanced in 1921, that there exists a relationship between ectopic pregnancy and chronic endocervicitis.

Patient twenty-six years old, married two years. Menstruation began at seventeen years, normal, except for pain. She consulted me July 2, 1924, complaining of pain in the lower abdomen, more on the left side, and profuse leucorrhea. She gave a history of having had a dilatation and curettage one year previously. A profuse vaginal discharge, with a lacerated, infected cervix were found. The uterus was small, anterior in position, slightly limited. Both adnexa were palpable and tender.

On July 16, 1924, I performed a tracheloplasty. Her complaints were markedly relieved. On April 5, 1926, I was called because the patient had had an amenorrhea since February 20, 1926, nausea, vomiting, faintness, and weakness. Physical examination revealed an enlarged soft uterus. Adnexa could not be felt. There was no tenderness in the fornices. On April 16 the patient began to bleed and had some abdominal pains. I sent her to the Bronx Hospital with a diagnosis of threatened abortion. The patient left the hospital in ten days, all pains and bleeding having ceased.

The pregnancy continued without serious complaint except for a general weakness and morning nausea. Quickening occurred in the latter part of July. The blood pressure, 120 systolic over 80 diastolic, varied very little up to October 5, 1926, when it rose to 140 systolic and 90 diastolic. The urine then contained a heavy trace of albumin, and the lower extremities showed some swelling. On

\*Presented at a meeting of the Section of Obstetrics and Gynecology, New York Academy of Medicine, November 22, 1927.

October 27 the urine almost boiled solid and showed blood and many pus cells. The blood pressure rose to 150 systolic over 100 diastolic. The patient complained of severe headache and insomnia.

On November 1, 1926, the patient entered the Hunts Point Hospital. Here, with enforced rest in bed, and with proper dieting and nursing she began to improve in kidney function, and the blood pressure came within the normal range. The headache and insomnia disappeared. Examination of the abdomen showed the fetus in the transverse position, the head lying on the left side. The fetal heart could be heard at a point to the right and a little above the umbilicus.

During the night of November 7 the patient had several severe abdominal pains coming at regular intervals. Vaginal examination showed the cervix was not obliterated, soft and the os was patulous. No definite presenting part could be ascertained. The fetal heart could be heard. The patient was comfortable the next day, but in the evening she complained of not having felt any fetal movements during the entire day. At this time the fetal heart was not audible at the point previously marked nor at any other part of the abdomen.

Even though the fetus was not viable, abdominal section was decided upon as the only safe and quick means of relieving this patient, because of the type of her pelvis (generally contracted), malposition of the fetus, and her preeclamptic state.

On November 9, upon opening the abdomen I found, instead of the uterus, a tumor mass, on the left half of which were three large venous sinuses running vertically. The omentum was markedly adherent to the anterior surface of the tumor. In separating the omentum, several large blood vessels were seen to enter the wall of the tumor. Incising the tumor to the right of the sinuses, a cavity with a thinned-out wall was entered. The fetus, which showed early signs of maceration, was removed. The cavity collapsed, the umbilical cord led down to the bottom of the cavity. The enlarged uterus was in evidence to the right of the median line. The patient was bleeding actively from the sac. The placenta, being partially detached, was entirely removed and a large gauze pack was put to the bottom of the cavity to temporarily control the bleeding. The broad ligament was ligated and as much of the leaves was cut away as was safe on account of the intestinal adhesions to the posterior layer. What remained of the cavity was repacked and the abdomen was closed. Stimulation and forcing fluids by hypodermoclysis helped to overcome the shock. Two and a half days later the patient expelled a decidua cast from the uterus. The patient was discharged December 22, 1926.

#### PATHOLOGIC REPORT

*Placenta*.—Weight 520 gm. Size 15 by 12 cm. On fetal surface near the insertion of cord which is central, can be seen an area about the size of a silver dollar, of apparent mucoid degeneration. On the attached surface can be seen scattered areas of fibrosis. The placenta is made up of two halves and seems as though it were folded on itself. Cord is 38 cm. long. In addition to placenta is a mass of tissue about 5 cm. square and  $\frac{1}{2}$  cm. thick. This may be part of broad ligament or thinned-out tube or ovary. A third mass consists of a piece of omentum, which was connected to the broad ligament opposite the placental site.

*Fetus*.—Male, weight 5 pounds, 14 ounces. The right side of the head is flattened, eliminating the facial outline, coming to a sharp ridge extending from the forehead to the chin; the left eye is protruding; the mouth is distorted; both upper and lower extremities are deformed. Evidence of beginning maceration on trunk is quite marked.

The following points of interest are noteworthy:

1. Presence of chronic endocervicitis with periadnexitis causing tubal distortion, thus predisposing patient to ectopic pregnancy.
2. Threatened abortion (?) with faintness continuing for two weeks.
3. Continued good health until eighth month of pregnancy.
4. Preeclamptic state.
5. Transverse position of the fetus.
6. Type of pelvis.
7. Abdominal section for nonviable fetus.
8. Placental insertion.
9. Decidual cast.

982 WHITLOCK AVENUE.

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## A CASE OF UNPIGMENTED SARCOMA OF THE VULVA IN A GIRL SIXTEEN YEARS OF AGE\*

BY HAROLD S. MORGAN, M.D., ANN ARBOR, MICH.

(*Instructor, Obstetrics and Gynecology, University of Michigan*)

ALTHOUGH sarcoma of the vulva is not in itself a rare condition, the unpigmented form of this tumor is quite uncommon. In textbooks the subject is usually dismissed with the comment that the condition is quite rare, while a search of the literature reveals that most of the sarcomas arising in the external genitalia of the female are of the pigmented or melano sarcomatous type.

In 1907, Bell collected and analyzed all the cases in the literature under the heading of sarcoma of the vulva. It is interesting to note that he found it necessary to reject a large number because they were of the pigmented variety. In this connection Torrgler points out that 38.46 per cent of all cases of sarcoma of the vulva are of the melanotic type. There are only three large groups of cases reported in the literature, those of Bell in 1907, a series of 32 collected by Labhardt and reported by Rothschild in 1912, and a series of 56 collected by Netzer in 1925. In addition to these there are a few scattered cases, the literature of which is not available, but the total number of cases on record will not exceed 60. A further idea of the rarity of this condition may be gained through the statement of Gurlt, who points out that in 483 cases of sarcomas, he had seen none of the genitalia. The following case, then, seems worthy of reporting.

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\*From the Department of Obstetrics and Gynecology, University Hospital, Ann Arbor, Michigan.

Miss P. B., aged sixteen, a school girl, entered in the Gynecologic Division of the Department of Obstetrics and Gynecology, University Hospital. Chief complaint tumor of the vulva.

The family and previous histories were negative and menstruation was normal.

The tumor was first noticed seven weeks prior to admission. It first appeared as a hard, exceedingly painful nodule at the outside of the right labium majus. She had had three operations for the removal of the tumor and had lost thirteen pounds since the onset of the trouble.

General examination was essentially negative save for the presence of enlarged painful lymph nodes in the right inguinal region. The urine showed many red and white blood cells. The blood showed secondary anemia.

The tumor occupied the right labium, was the size of a small hen's egg, was eroded and the surface was covered by a thin serous discharge. The mass extended well up the lateral wall on the right side, almost to the cervix posteriorly and underneath the symphysis anteriorly. The tumor was firm and fixed in position, and the pain on manipulation was very severe.

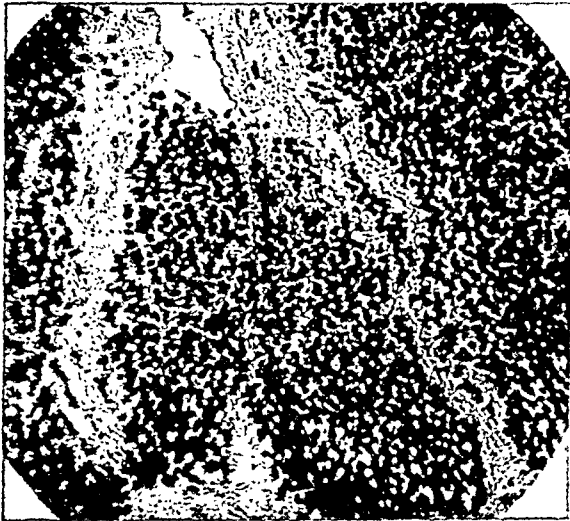


Fig. 1.—Photomicrograph of sarcoma of vulva, showing general structure.

A small bit of the tumor was removed for examination and the Department of Pathology, reported as follows: "Examination of the tissue removed shows a cellular, rapidly growing neoplasm of the alveolar round-cell sarcoma type. The tissue is exceedingly vascular. A small bit of the atrophic Bartholin gland is included."

The lungs were x-rayed for possible metastasis, and twelve radon seeds of one-half millicurie each were placed in the tumor. Two days later there was a decrease in the tenderness and in the size of the tumor. One month later the patient suddenly complained of pain in the middle third of the left femur and both hips. Roentgenograms showed no evidence of metastasis to the femur, but disclosed a destruction of the right ilium and a resorption of the bone in the inferior ramus of the right pubis. The radon seeds were removed, and the mass was reduced in size and distinctly less painful. A series of deep x-ray treatments was given the patient and she was advised to return in one month for additional treatment. This she failed to do and a communication from her local physician stated that she was too weak to make the trip and that she could in all probabilities live only a few weeks.

## DISCUSSION

In Bell's group of cases eleven of the growths arose in the labium majus, three from the labium minus, three from the clitoris, and three from the region of the urethra. In Rothschild's group sixteen arose in the labium majus.

No particular portion of the external genitalia seems to be the site of predilection of this neoplasm unless it be the labium majus. This view is held by some who point out that the labium majus contains the largest amount of connective tissue. Carbone points out that the newgrowth seems to follow the fibro-elastic tissue, which penetrates deeply and forms the suspensory ligaments of the clitoris. He likewise states that where a capsule surrounds the neoplasm, it is probably derived from the elastic sac of the labium majus which is analogous with the tunica dartos of the male. Rhomberg also believes that these neoplasms arise from the subcutaneous connective tissue and Veit

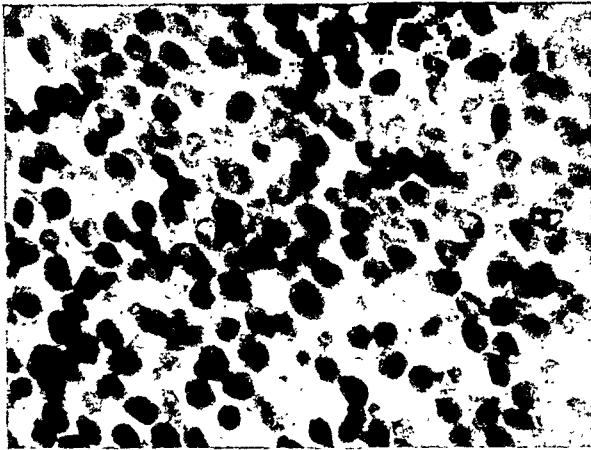


Fig. 2.—Photomicrograph of sarcoma of vulva, showing large round cells.

states that since these tumors often show signs of fibromas, they may well derive their origin from the round ligament in the labium majus. He adds that the Bartholin glands may be the points of origin in some cases. Although bits of tissue from the gland were included in our specimen, there is nothing to prove that the gland was the point of origin.

Attention is drawn by Netzer to the fact that microscopic examination of the excised tumor frequently shows evidence of malignant degeneration of a fibroma of the vulva, and as a further verification of this belief the case of von Winkel is cited, where a young woman of twenty-five had a tumor of the vulva which took on malignant change two or three years after the small lump was first noticed.

As to the age incidence, Veit reports the age group to be from twelve to seventy-four years, while according to Bell, this type of



sarcoma is seen most frequently between thirty and fifty years. The incidence in multiparae and nulliparae seem to be equally divided.

Sarcoma of the vulva is a rapidly growing tumor of a very malignant nature with early metastasis to distant organs. The melanotic variety, however, is much more malignant and metastasizes earlier than the unpigmented variety. Metastasis to the mouth and lungs have been noted, and the brain is commonly found infiltrated with sarcomatous cells. Metastasis has been hastened in some cases by biopsy. In our own case metastasis had undoubtedly occurred when the patient was first seen, for the inguinal glands on the right were enlarged, hard, and painful. Later on destruction of the ilium and pubis was demonstrated by x-rays, and although autopsy was not obtained it is reasonable to believe that metastasis had occurred elsewhere in the body, because the patient became weaker and more emaciated and was on the verge of death when last heard from shortly after she left the hospital.

These tumors are usually made up of polymorphous cells, varying in type from spindle to round. Our own case was composed almost entirely of large round cells, divided by the vascular stroma into a somewhat alveolar structure, so that the tumor was in part a large round-cell alveolar sarcoma.

A word may be said about the treatment of this case. The patient had had three previous operations, the exact nature of which is not known. At the time of admission to the hospital it was felt that extension had taken place and that radical operation offered no chance of cure. Radium in the form of radon seeds to be followed by deep x-ray was the therapy advised. Twelve radon seeds were inserted in the mass and were left in situ one month and was followed by considerable shrinkage of the growth.

In the earlier literature on the subject radical excision of the growth was the treatment suggested by most of the writers. Viet reports 5 per cent of cures in cases following radical operation. Kelly also believes that radical excision of the growth offers the best chance of cure. It must be remembered that x-ray and radium therapy were not in their present day state of development, and little experience had been had with these agents, though Veit believed that excision followed by deep therapy would offer an even better chance for cure. It is our own feeling that had the sarcoma been seen early enough, radical excision followed by deep x-ray therapy would have been the treatment of choice, but in the presence of almost certain metastasis, excision was of no avail. The results of radium and x-ray therapy alone on these neoplasms can only be conjectural, based upon the results of such therapy in malignancies elsewhere in the body.

## CONCLUSIONS

1. Sarcoma of the vulva is usually fatal, though early diagnosis and excision followed by intensive x-ray therapy offer the patient the best chance.

2. All growths about the vulva, particularly fibromas and hard tumors in the region of the Bartholin glands should be removed immediately to eliminate the danger of sarcomatous degeneration.

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UNIVERSITY HOSPITAL.

## A CONSTANT-TEMPERATURE APPARATUS FOR USE DURING CONTINUOUS INTRAVENOUS ADMINISTRATION OF FLUIDS

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Medical School)

THE intravenous administration of glucose solution is recognized as a rational therapeutic procedure in various medical and surgical conditions. It is in the field of obstetrics that such injections have been most frequently employed.

In order that the best results be derived from intravenous glucose therapy, certain requisites must be observed. These have been adequately outlined by Titus and Dodds.<sup>1</sup> Not only is it necessary to use a properly prepared and properly sterilized solution, but the fluid must not enter the blood stream too rapidly and it must not be too cool or too warm. A method for ascertaining and controlling the rate of flow of intravenous infusion fluids has been devised by Freidell.<sup>2</sup> A simple means for maintaining the temperature of the solution has been described by Titus and Dodds.<sup>1</sup>

For this purpose, the rubber tube conducting the liquid from the container to the patient is coiled in a basin of hot water. The employment of this method necessarily entails considerable supervision

on the part of an attendant in keeping the water at the proper temperature and the correct length of tubing submerged. In an attempt to minimize the amount of attention required during these slow infusions, an automatic temperature-regulating mechanism has been constructed.

The injection apparatus, as shown in Fig. 1, embodies the rate-controlling device of Freidell.<sup>2</sup> *A* is a reservoir containing the stock glucose solution. *B* is a salvarsan jar. *C* is a graduated burette. The rubber tubing has interposed in its course a piece of glass tubing in which a dilatation has been blown. These are immersed in the

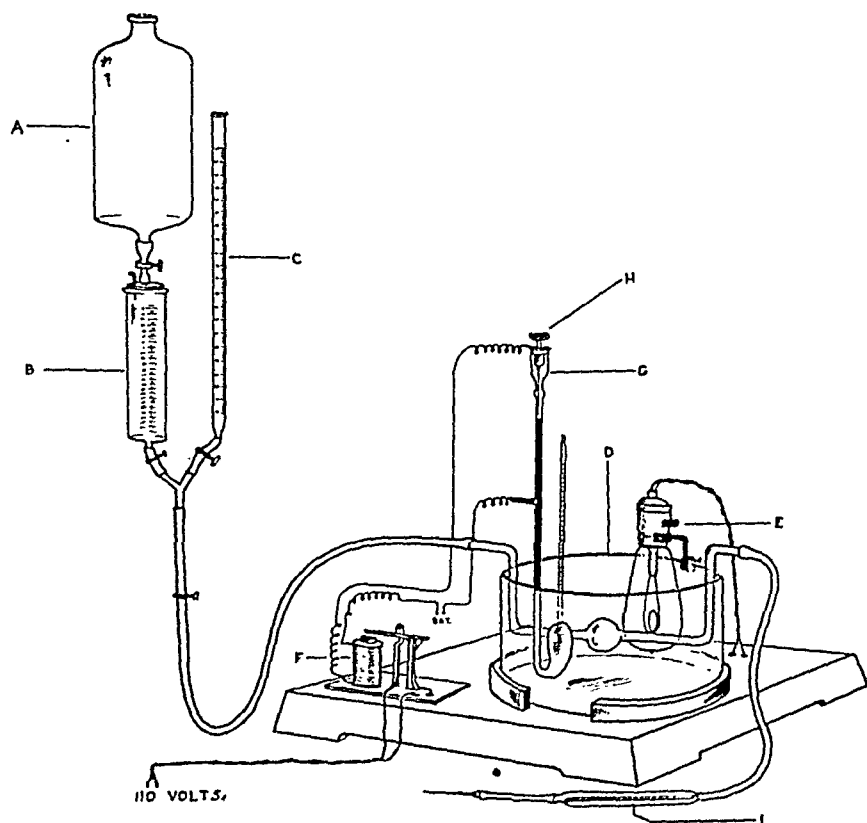


Fig. 1.

water-bath *D*. The water in the bath is heated by means of the electric light bulb *E*. When the temperature of the water reaches the required degree, the light is automatically shut off by the key *F*, through the agency of the thermostat *G*. When the temperature of the water falls, the light goes on again. The thermostat can be made to operate at any desired temperature by adjusting the screw *H*. The temperature of the infusion fluid near the point of entrance into the vein, may be viewed on the thermometer *I*, situated within a short piece of glass tubing.

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# Department of Maternal Welfare

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CONDUCTED BY FRED L. ADAIR, M.D.

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## A FRONTIER NURSING SERVICE\*

BY MARY BRECKINRIDGE, R.N.

(*Director, Frontier Nursing Service, Wendover, Ky.*)

**A** MOVEMENT is of just as much value as the goal it sets itself and the success with which its activities tend to reach that goal. The purpose of the Frontier Nursing Service is to reduce the maternal and infant death rate in remote areas by providing resident nurse-midwives, trained and licensed as nurses and as midwives, by civilization's centers for work in its outposts, in cooperation with the nearest available medical supply. Why is such a plan desirable? How is it made practical?

We must start off with a bit of history. Our association, under its original name of Kentucky Committee for Mothers and Babies, Inc., began its work in the Kentucky mountains; first, because those of us who conceived the project and were willing to give time and money to launch it, were Kentuckians, and second, because few mountains are more inaccessible than ours. The area we chose has for hundreds of square miles no railroad, no automobile road, no bridges over its rivers and streams. Horseback and mule team are the only possible mode of travel. We felt that if we could put the project over in the Kentucky mountains it would be feasible to duplicate it afterwards anywhere. The third reason for our choice lay in Dr. Arthur MacCormack—a State Board of Health officer of such broad understanding that a new venture for the public good in Kentucky met at once with his sympathetic and cordial cooperation.

Lastly, we considered the quality of the people, shut off for over a century from the advance of medical science by their towering hills. The Kentucky mountaineer has been faithfully portrayed in the stories of John Fox Jr. and Lucy Furman, and the reports of the famous Berea, Hindman, and Pine Mountain Schools. To these I shall add a word of hard science, procured by Ella Woodyard, Ph.D., of the Institute of Educational Research of Columbia's Teachers College. She came down at our invitation and took the intelligence quotient of over 60 children between the ages of six and ten, children of several counties picked up by the roadside quite at random, none with any schooling to speak of, and about 80 per cent with hookworm. Their median intelligence quotient was 90.6. A similar group of American-born Italian children in New York schools, tested at about this time by the Institute, scored under 90. The old American stock which explored and established this country is still gloriously well worth while.

As we made ready to begin we realized fully, at the outset, the vastness of our undertaking. The Appalachian Mountain range covers 115,000 square miles

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\*The above is a faithful representation of a situation that is still largely unknown to most of our readers. A brave and courageous little band of women have attacked and are solving this problem to the best of their abilities and evidently with success. There are other localities in this country where similar conditions exist. Upon their amelioration by this or like methods will depend that lowering of the maternal mortality and morbidity rate of which these United States have been so severely criticized.—THE EDITOR.

and holds about 6,000,000 people of whom something over 200,000 are in the Kentucky mountains alone. Except in its few towns, and at an occasional school or mission station, the medical and nursing service for this population is negligible. No figures are obtainable, but in the area where we began there was not one registered physician for nearly 15,000 people in over fully 700 square miles, covering one whole county and the borders of several others. It took the nearest doctor six to twenty hours to reach a patient, on horseback, at, necessarily, a fee prohibitive for any but a few families. That the financial adjustment of this mileage and time burden should fall on either the overworked practitioner in the little town, or the patient living on land worth only a few dollars an acre, is manifestly unfair to both. In America today people are penalized by geographic remoteness. This is not the case only in the southern Appalachians. A tragic instance of medical need was reported last winter from Idaho, with the nearest doctor 100 miles by dog team away. It is said there is one public health nurse to every 100,000 of the population in Arkansas, where the Ozark country presents vast difficulties. This is all the more deplorable as most of the twenty-odd million Americans living in these frontier sections are (like the Kentuckians) of old pioneer stock, and are practically the only self-sustaining people in our national life. They import almost nothing, but are bred to a hardy livelihood. They export many basic products such as lumber, wool, meat. We could ill sustain our national life without their efforts. But we have left their women and children at the mercy of distance and medieval practices. This is certainly an outstanding factor in our high maternal death rate, which would be higher, not lower, could we get at all the facts, and in our annual loss of 200,000 infants by stillbirth and in the first month of life. This is the condition our organization seeks to ameliorate by an adaptation of methods which have proved successful in other countries with a lower maternal death rate than our own.

Before the actual beginning we took two steps we considered fundamental.

First, we checked up on the existing obstetric situation in a mountain area of 1,000 square miles, with a population just under 30,000. This fell to my lot, and took over two months of horseback travel through three counties. In the preceding year 968 births had been reported from these counties, 144 by 9 doctors (not all, however, were state licensed or qualified doctors) and 824 by 128 midwives. I found 20 other midwives who had not recorded or reported their deliveries, and I am sure there were more, but I did not cover the section minutely. A point I want to stress right here is not the obvious one of local custom in the preference shown for women accoucheurs, but that the mothers in this territory had used at least 157 attendants for their deliveries in one year. Our subsequent experience in the same rough country, without telephones, has taught us conclusively that a delivery service cannot be successfully handled under such conditions in more than a five mile radius. It is difficult to get even five miles on horseback over rough trails and swollen streams on stormy winter nights with any speed.

The rule of our service is simple—if the "daddy" can come for us we can go with him. Once the patient is in labor and the nurse-midwife has been called, she cannot leave her case. If complications supervene she has to send a man on a mule for a doctor. If an emergency arises she must act as she has been taught until he comes. Sometimes we can get a doctor in a few hours. Sometimes the need has passed before he can possibly arrive. Last summer when one of the two doctors in the county was away and one (a married woman) had a young baby, we sent to three counties and were three days getting a doctor for a case of placenta previa. Meanwhile we speccialed the patient, and she would have died had we not done that. The doctor who came rode 33 miles on horseback at a stretch, with a fresh horse and sandwiches and a guide provided at our first center, spent

the night with the patient, did a version, and saved her life. Then he rode the 33 miles back to his own practice the next day. It will be seen that our problem is not academic. We live with it and in it every day.

Our first fundamental step, then, was to study the existing obstetric situation. From this study we learned three things. One was that 30,000 people scattered over 1,000 square miles in a rough country, have got to have a number of obstetric attendants, *decentralized* living at regional intervals within reach of the patients, if the patients are to get any delivery service and any postpartum care whatever. Second, we found that the existing medical supply, especially if limited to state qualified doctors (for a number of so-called doctors practice on county permits and are grossly unfit), could not possibly handle these deliveries even if the mothers wished male practitioners and could afford it. The existing medical supply is not even adequate for consultation, nor always equipped to that end.

Third, we learned by our study that it was useless to try to improve the quality of the native midwife. I had my investigation of 53 (made in their own homes, scattered over three counties) tabulated. The average age was 60.3. That is not a teachable age. The native midwife does not begin to practice until she is over forty and has "raised" her family.

The material in this report covers twenty-seven pages, plus the tables, and has been privately printed. It shows the native midwives just as ordinary citizens, beginning their practice as neighbors in a lonely country, because they had to do it. Their mental levels vary from the extremely stupid to the really intelligent, and their persons and cabins from dirty to clean. All are grossly ignorant and deeply superstitious.

Having then learned that attendants sufficiently numerous to live within reach of their patients were essential to a delivery service in the frontiers, that the medical supply was wholly inadequate, and the native midwife unimprovable, we took our second fundamental step. We accepted the principle of the trained midwife as the right person to replace the untrained one, and began a long study of the methods and the results in those other nations who make use of her. This also fell to my lot and consumed the better part of eighteen months, during which I took a midwife's training in London and qualified by examination under the English Central Midwives Board.

We early decided that the Anglo-Saxon plan of combining nursing and midwifery in country districts would fit better into our American tradition than the Continental system of specialization. It is economically feasible in remotely rural work not to have two people covering the same ground for public health work and for midwifery. It also allows the nurse-midwife to fill her time profitably between cases, which sometimes fall far apart in sparsely settled areas. The famous Queen's Nurses of Great Britain, under the generalized system, have a death rate half the national and one-fourth that of ours in the United States. Their midwifery service cares for some 40,000 to 50,000 women annually in England alone.\*

It was in the Scotch Highlands that we found the plan for our local Kentucky formation. In 1924 I made a trip through this region, covering many of the stormy islands of the Outer Hebrides. For every 700 or so of the population I found a splendid resident nurse-midwife, living in the heart of her district, often with the thundering seas between her lonely island and the nearest medical man, with whom she communicated by telegraph, and operating under a local voluntary committee, composed of her own leading people. When we came at last, after this

\*British Medical Journal January 8, 1927; Observations on the Maternal Mortality in the Midwifery Service of the Queen Victoria's Jubilee Institute, by John S. Fairbairn.

long preparation in the summer of 1925, to organize our Kentucky venture, we adapted the Scotch Highland system to our own situation.

Our method is one of *decentralization*. The nurse-midwives live in little houses in the heart of their districts of not more (sometimes less) than a five mile radius, which is about 78 square miles. We have four of these centers to date, with money for a fifth to be opened this summer, and we cover about 250 square miles. Our staff, besides myself, consists of a supervisor, six nurse-midwives and two nurses who are not midwives and do not carry responsibility for this part of the work, except their share of the postpartum nursing. All of our eight nurse-midwives got their midwifery in England, three at their own expense, one on our scholarship, and the rest are English—three out of four members of the famous Queen's service. We have applications weekly from British trained nurses from all over the world (Bermuda, South Africa, Nova Scotia, Great Britain, Canada, the United States) and from American nurses who would come to us if they could get the midwifery. But our scholarship funds are limited, and kept for the few nurses who have been tried out in our 'difficult field.

Our work is carried forward on horseback. Each nurse saddles and grooms and feeds her own animal. Each nurse has two pairs of saddlebags—one with blue checked, detachable lining for general nursing and one with white lining for midwifery. The nurse-midwife resterilizes its contents and sets a filled lantern by it immediately after a case. Very few of our homes (which are mostly one or two room cabins) have a light other than the open fire. We carry for the delivery a rubber apron, a clean operating gown, and a V.A.D. cap to cover completely the hair. We use white in the dispensaries at the centers, as well as on the cases, but our regular uniforms are cadet gray riding coat, breeches, and overseas cap.

Our midwifery bags weigh 48 lbs. packed (10 lbs. more than the general nursing bags)—the weight evenly distributed to both sides of the horse. The midwifery equipment includes soap, scrubbing brush, gloves, thermometer, enema tube and funnel, artery clamps, hypodermic set, scissors, and cord ties, with more basins than would be needed in the city home, and a two yard square of rubber sheeting. We carry plenty of dry sterile gauze and cotton, in little white bags, and perineal pads baked in the oven, and towels. For the bed, after delivery, we use pads made of clean rags and newspaper, but these, like the baby clothes, are in the home before the call comes. Among drugs we carry lysol, silver nitrate ampoules, and ergot. It is routine to give a teaspoonful of ergot in water before leaving the patient, not less than one hour after delivery. Dr. MacCormack, who gives us our special licenses on the basis of our C.M.B. certificates, authorizes us to practice as nearly in accord with the rules of the C.M.B. as can be carried out in the mountains. Under this ruling we carry pituitrin, in case of postpartum hemorrhage, provided the third stage is complete—and sedatives for the first stage. Our aim is to get a quiet first stage, and a second stage without a tear by delivering between pains when the head is fully crowned, and with a minimum of bleeding. We usually deliver on the left side, as we were taught, keeping careful pressure on the fundus and following down with the left hand.

The third stage causes us the deepest anxiety, because upon our judgment alone hangs the life of the patient should the third stage not be normally complete, as medical aid could not possibly reach us until too late. We have twice in our first 130 deliveries had adherent placentas with terrible bleeding, and these are the only postpartum hemorrhages we have had. Our routine calls for a sterile glove always ready for manual removal in such a contingency.

It is impossible in a paper of this length to go fully into details of special cases, and our service is as yet too recent and too small to afford material of statistical value. The Metropolitan Life Insurance Company is going to tabulate

our first 200 cases—because they do offer, though on so small a scale, matter for reflection. It suffices at present to indicate a few things which will be of interest to the sympathetic and informed readers of the Journal.

While nearly all of our cases have been normal, the following abnormal conditions appeared in the first 130 deliveries. It must be borne in mind that the 130 do not include all the cases we entered as prenatals, but only those we delivered ourselves or personally called in doctors for the delivery. Some of our prenatals still choose to be delivered by the native midwife—mostly their own grandmothers and great-aunts. Our policy is one of friendliness toward the “grannies.” We are oozing in, not bursting in, to replace them, and no new ones begin to practice once we are established in a district. We are letting nature take her time with the old.

In addition to the two hemorrhages from adherent placentas we have had three antepartum hemorrhages from placenta previa—two central and one marginal. We had one eclamptic, the convulsions coming just after delivery. This case was beyond our district and registered late but had normal symptoms until four days before delivery, when her blood pressure rose to 118 and there was a trace of albumin, which had persisted when seen two days before delivery.

We have had one hand presentation at 26 weeks with spontaneous delivery, and one face presentation (an anencephalic monster). There have been several transverse positions restituted and held with binders, several premature births and miscarriages. We have had second degree tears, one case a precipitate before the arrival of the nurse. These will have to be repaired later. We also have had eight cases with elevation of temperature above 100°, though none persisted. No case has been septic. None has needed forceps. None have died.

We gratefully acknowledge help from the medical profession whenever obtainable. The big metropolitan doctors among our trustees in Lexington and Louisville have cared for cases of all kinds (not only obstetrical and gynecologic) sent down to them on passes given us by the Louisville & Nashville Railroad—and always involving at least a day’s horseback ride and a night on the train. The scattered doctors through the mountains from three counties come at once if they can be reached when we call. In calling we again follow the rules of the Central Midwives Board. To illustrate: The nurse-midwife on the delivery which turned out to be a face presentation, could not make out the presentation and sent for a doctor on that account. The C.M.B. rules state emphatically to send for medical aid if a normal presentation cannot be made out. A doctor now resident in that part of the county was at home at the time of this case and so the midwife was able to get him.

We have obtained doctors for prenatals with high blood pressure, vaginal discharge, history of stillbirths, general medical conditions, and for miscarriage.

Now, as to the babies. We have had five stillbirths—the two cases of central placenta previa and the monster with face presentation, a case following influenza, and the six months’ premature fetus with a hand presentation that was delivered spontaneously, the doctor before mentioned being present. We count the losses which occur when a doctor is present as our own. This is the English custom. A maternal death or stillbirth is counted against the midwife’s record even if a doctor has been called and has taken charge, if it was she who first took the case. We have lost only one baby (the six months’ premature) in the first month of life. In our baby hygiene nursing we have carried 471 infants under two years since our work began, with one nurse, at one center, two and a half years ago.

Our treatment of the newborn baby is to wipe his eyes, from the center outward, with dry sterile gauze, once the head is born, and to clamp the cord. Baby is then wrapped in his blanket in such a way as to keep his hands out of his eyes, and



PROF. GAMMELTOFT (closing) said in answer to Dr. Beek's question relative to treatment that they had been using old-salvarsan, that subsequently they had changed to neosalvarsan and silver salvarsan, and that they had not noticed any difference between them. He added that the bismuth treatment is not as good as the salvarsan treatment.

The speaker said that they had investigated the deaths after the use of salvarsan. In one of the largest hospitals in Denmark for the treatment of venereal disease there had been four cases of salvarsan poisoning within ten years terminating in the death of the patients. Three of these deaths were in pregnant women. Prof. Gammeltoft stated that he believed with Dr. Beek that if the urine were examined carefully, there is no doubt that pregnant women may be safely treated with salvarsan.

The speaker then discussed the question of the Wassermann reaction and referred to the variability in the reports, stating that in some places, if one sends specimens of blood to three or four different stations, the reports are not always the same. He said that in Denmark a very important progress was made when the government of that country took charge of the Wassermann reaction by having the State Serum Institute (Dr. Th. Madsen) carry out practically all the Wassermann reactions done in Denmark. In Denmark this arrangement has greatly lessened that uncertainty about the Wassermann reaction which still prevails in some places.

In discussing the sensitiveness of the reaction the speaker pointed out that the reaction can be made more or less sensitive. And he mentioned that the obstetric clinic did not want the reaction to be hypersensitive for the reason that with a reliable technic and a nonhypersensitive reaction even a weak positive result is a definite criterion of the presence of syphilis. With the method employed by the Danish State Serum Institute it is conceivable that in extremely rare instances a case of syphilis may be overlooked; but, on the other hand, even a weak reaction is an unquestionable sign of syphilis.

The speaker then discussed the question of whether a case of syphilis should be treated by the obstetrician or a specialist. He believed that the dermatologist was best able to cope with these cases. And he added that as far as Denmark was concerned there was no difficulty about the transfer of syphilitic patients to the specialist.

With regard to the children the professor emphasized the point that the constant observation of the child in the "Special Department" for the first six months of life is quite different from seeing the child once every two or three weeks. In some children, he said, the first rash is very slight, and if one sees such a child eight days later, the rash has disappeared, one finds no visible sign of syphilis, and a subsequent positive Wassermann reaction comes as a surprise.

The professor replied to the question asked by Dr. Thalheimer relative to the reaction during pregnancy, that pregnancy in itself produces no positive reaction. Babies with a weak positive reaction and no clinical sign of syphilis are not treated.

The speaker next discussed the question of the transmission of syphilitic antibodies from mother to child, and stated that he considered such transmission possible without the child being infected.

Answering Dr. Moench's question, Prof. Gammeltoft said that their incidence of 6 per cent of syphilis was the average percentage in his clinic. He referred to the fact that this clinic dated from the year 1759, and, after speaking of the object for which it was primarily founded, he went on to say that their patients consist of unmarried women, normal cases in very poor women, and married women with some complication of pregnancy, but that they are not allowed to admit any normal cases which are able to pay, and that this limitation of admission is the reason why they have such a high percentage of syphilis in their

clinic. He believed they had been able to reduce the percentage of syphilis in later years, but it was very curious to notice how the incidence of syphilis always goes up and down. He said that about six months ago the incidence of syphilis was very low, and that in the last three or four months before his departure from Denmark the incidence had risen once more. On the whole, he believed, they have a right to feel that there has been a decrease of syphilis in later years. He referred to the laws affecting prostitution and said that he did not believe that the application of legal measures for the abolition of prostitution has resulted in any increase of the disease, but—on the whole—rather a decrease.

Responding to Dr. Frank's question respecting the alternating cases of congenital syphilis and normal children, the professor said he was unable to offer any explanation of this apparent capriciousness of nature. Some people, he said, believe that white infarets have something to do with syphilis, but he did not think that this theory would at all hold good. In this connection he referred to the work of Olaf Thomsen. He said he only mentioned the question of the white infaret in placenta because it may be possible that the infection sometimes travels through the infaret to the child.

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## PHILADELPHIA OBSTETRICAL SOCIETY

STATED MEETING, MAY 5, 1927

DR. JOHN H. GIRVIN presented a report of three cases of **High Anterior Accidental Fixation of Uterus Following Cesarean Section.**

CASE 1.—Mrs. T. D., Italian, aged forty, admitted to Presbyterian Hospital October 4, 1926. Complained of "tumor" in the right side of abdomen which had been present for five months; recently slight pain over this mass.

Always enjoyed good health, has had 12 pregnancies, (2 miscarriages at 3 months, 10 full-term babies, 6 of which are living). Present illness dates from last labor, March 5, 1926, at which time a cesarean section was done. After 8 hours of active labor, the fetal head had not engaged and the patient's general strength was failing. Cesarean section was done in the usual manner and both tubes were bisected near the cornual end and the stumps buried in the layers of the broad ligament. Postoperative convalescence normal, and for two months afterward the patient felt well. Then she began to notice a tender swelling in the right lower quadrant of the abdomen with occasional pain in this region. Periods had been scant since operation and she had a moderate yellow vaginal discharge.

General physical examination was essentially negative. Abdominal scar  $3\frac{1}{2}$  inches long, slightly to left of midline, extending  $\frac{1}{2}$  inch above umbilicus and about 3 inches below. In right lower quadrant was a hard, tender mass about 3 inches across, smooth, firm and slightly movable in all directions. Tentative diagnosis, high fixation of uterus following cesarean section.

On October 5, the patient was operated upon by Dr. Laws. When the peritoneum was opened the uterus was found to be adherent to the abdominal wall, just below and to the right of the navel, at the site of the cesarean incision, in the fundus. The very dense adhesions were cut and while this was being done the uterus was torn open at the site of the old wound and thick reddish yellow material exuded. A supravaginal hysterectomy and right salpingectomy were done and the appendix removed. Drainage was considered but not done and the abdomen closed in the customary manner.

The postoperative course was rather stormy. For 6 days she ran a temperature of 101°, pulse of 120 and had considerable pain. There was a foul, watery vaginal discharge, a smear of which showed many gram-positive organisms and an occasional pus cell. On the ninth day the fever had come down slightly, averaging about 100°. The wound appeared normal. Sutures were removed on the twelfth day. A large amount of pus escaped, the wound was drained and Dakinized, and within ten days it began to heal, and 40 days after operation patient was discharged in good condition.

CASE 2.—Mrs. E. H., white, American, aged 26, came to Gynecological Dispensary, Presbyterian Hospital, October 5, 1926. Complained of severe occipital headache, dyspareunia and pain in left lower part of abdomen. Previous medical history negative. She had had one pregnancy with cesarean section at term, June, 1923, done after patient had been in labor for 36 hours. She had been told this was necessary on account of "rigid muscles." The incision drained pus and did not entirely heal until 3 months after the section. Both fallopian tubes were cut at time of operation.

Since operation, patient has had frequent occipital headaches lasting from one to three days, occasionally associated with nausea and vomiting.

Also complained of dyspareunia which dates from time of operation, there being exquisite tenderness high up in the vagina. During the past two months patient has had vague pain in the lower abdomen.

A palpable tender mass was noted beneath the abdominal scar extending from the umbilicus to the symphysis.

Pelvic examination revealed a normal vulva and perineum. Marked tenderness of both anterior and posterior vaginal walls. The uterus was apparently normal in size but fixed at the location of the navel.

Tentative diagnosis was made of tension of the broad ligaments from high fixation of the uterus.

Admitted to hospital October 27 and operation by Dr. Girvin October 29. The fundus was at the level of the umbilicus, and adherent under the old incision by a firm band near the right cornu on the anterior surface. The uterus was liberated. Both tubes had been removed and the stumps buried. The end of the left stump was separated and incised. The right tubal stump was cut off close to the uterus and the right ovary sutured to the right cornu. The uterus was then suspended to the abdominal wall in its normal position, and in the usual manner. Abdominal wound closed in the usual manner.

The patient was desirous of being left in condition to have other children, if it were at all possible after her previous sterilization, therefore before our operation was begun, pelvic measurements were taken and were found to be essentially normal, internal conjugate diagonal being 11 cm. and the transverse of the outlet being 11 cm.

The patient made an uneventful recovery. Fourteen days after operation a Rubin test was performed to determine whether the left stump was patulous. The gas pressure rose steadily three times to 120, 120 and to 130 mm. Hg., and on each occasion auscultation showed the gas passing into the abdomen on the left side.

Patient was discharged from the hospital 17 days after operation as cured. There was no pain and no recurrence of her headaches.

Returned to clinic three and a half months after her operation. Rubin test showed the gas passed through the left tube at a pressure of 120 mm. Hg. She has had no recurrence of her occipital headache and no pain in the abdomen, but stated that, so far, she could not report on the dyspareunia, but it can safely be said that vaginal examination no longer caused the pain that it did before operation.

CASE 3.—F. B., colored, age forty-one. Admitted to Gynecological Dispensary, March 3, 1927. Chief complaint pain in left side of abdomen for four months. She had always been well. Has had two pregnancies, the first child delivered by cesarean section 23 years ago, second labor normal, 19 years ago. Menstrual history negative except for slight pain in left side for the past four months. Periods are now beginning to be a little irregular and more scant.

The pain came on 2 to 3 days before onset of period. Occasionally vomited during pain, but it seems to have no relation to the gastrointestinal tract.

Cervix found drawn up high on anterior vaginal wall. Uterus seems slightly larger than normal and is adherent to scar of abdominal operation. No tenderness or mass in either lateral fornix.

The lipiodol x-ray showed an elongated uterus fixed to anterior abdominal wall. Operation postponed.

DR. J. O. ARNOLD considered that any cesarean section that is not followed by an absolutely normal temperature must at least be watched for some such sequence as here reported.

### DR. J. S. RAUDENBUSH presented **An Improved Type of Pessary.**

He first devised this type of pessary about fifteen years ago. This is a globe pessary\* with a short vaginal stem, absolutely smooth throughout so that no acrid

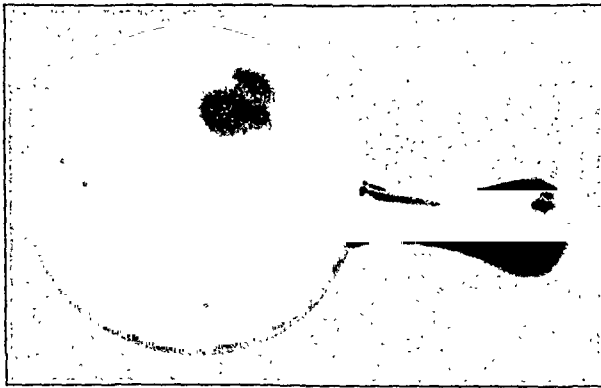


Fig. 1. (Raudenbush.)

secretions could be harbored in the instrument itself. This instrument can be removed by the patient in the evening so that she may take a cleansing vaginal douche, and in this way prevent the consequences of prolonged and continued pressure and of penned-up irritating discharges. In this way she is practically one-third of the time out of every twenty-four hours without a foreign body. In the morning she can replace it.

### DR. BERNARD MANN presented a **Metal Douche Nozzle.**

It is made in two parts: A metal tubing five inches long, slightly curved at the junction of the upper and lower two-thirds, and a detachable bulbous tip with three perforations. The advantages of this nozzle are cleanliness, may be sterilized by boiling, and will not break.

The glass nozzle frequently breaks and broken pieces must be removed from the vagina. The hard rubber nozzle is not satisfactory because it cannot be sterilized satisfactorily.

\*Made by the Physicians Supply Company of Philadelphia, Pa.

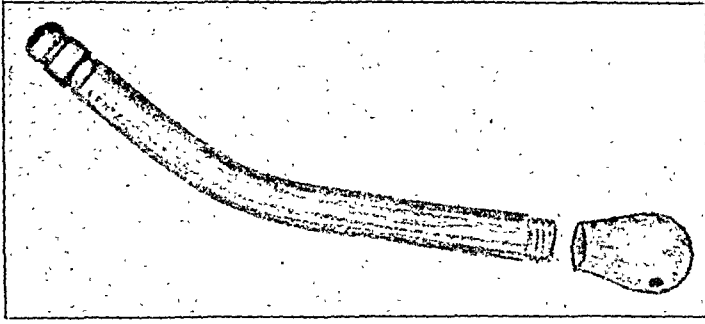


Fig. 1. (Mann.)

### DR. LEONARD AVERETT reported a successful case of **Artificial Insemination.**

Mrs. F. S., age twenty; married two years and had not conceived.  
Menstrual history negative.

A Rubin test was advised, a dilatation was done, and a Baldwin drain inserted in the cervix and uterus to overcome the acute anteversion; this, however, was to be preceded by an examination of the husband's seminal fluid which showed a large quantity of motile spermatozoa. On April 25, 1924, the patient was admitted to St. Agnes Hospital and operated upon the following day. The Rubin test showed her fallopian tubes to be patulous. Her recovery was uneventful and on May 5, she left the hospital. On June 9, 1924, the Baldwin drain was removed.

Her menstrual periods were unchanged as to regularity and duration except for the subsiding of her dysmenorrhea and the menstrual flow being more profuse.

Not having conceived subsequently, she became despondent and began showing signs of melancholia. Endocrine therapy was tried without success. The Hühner test showed motile spermatozoa two and one-half hours after ejaculation.

She was inseminated on October 15, 1925, unsuccessfully, menstruating again on November 5. On November 12, the insemination was repeated with like results. On December 12, 1925, she was again inseminated. In January, 1926 she did not menstruate, and soon thereafter began to show the usual signs of pregnancy; had very little digestive disturbances and enjoyed good health during her entire prenatal period. Her melancholia soon cleared up and she was in very good spirits. On September 15, 1926, she was delivered, without interference, of a male child weighing 8 pounds. There were no postpartum complications.

### DISCUSSION

DR. ALFRED HEINEBERG said that after considerable experience in the last few years with the Hühner test there is one point in connection with it which requires emphasis. As first carried out by Hühner, he tested for the mobility of the spermatozoa in the cervical canal and cavity of the uterus. If he found the spermatozoa immobile in the cervical secretion he made an attempt to remove spermatozoa from the uterine cavity through a cannula attached to a syringe. In performing this test, Dr. Heineberg found that if the smallest quantity of blood became mixed with the semen the mobility of the spermatozoa was immediately destroyed. Therefore unless one is exceedingly careful in introducing the Rubin cannula into the uterus in order to avoid trauma of the cervical tissue and at the same time forcing blood into the uterine cavity, the attempt at artificial insemination could not help being negative on account of the mixture of blood with the seminal fluid. A point of criticism that might be made in regard to the method employed by Dr. Averett is that it hardly seems necessary to employ a cannula as large as that of Rubin. A much smaller cannula can be utilized in injection of semen into the

uterus and this will eliminate trauma of cervical tissue, especially where the cervical os is very much contracted. It is possible that a certain percentage of trials at artificial insemination are unsuccessful on account of the blood from the cervical tissue being mixed with the seminal fluid.

DR. J. C. HIRST, II, read a paper entitled **The Technic of Intrauterine Lipiodol Injections in Gynecologic Diagnosis.** (For original article see page 797.)

#### DISCUSSION

DR. BROOKE M. ANSPACH said that the question remains as to how much good it will do us to find out where an obstruction is located because operation on such tubes is so notoriously barren of results. When Dr. Hirst spoke of a death from peritonitis following a salpingostomy, Dr. Anspach was reminded of a personal experience. The patient was very anxious to have children; the tubes had been injected with sodium iodide and excellent pictures obtained. Operation was done within a week of the injection and consisted simply of releasing the adhesions and opening the tubes. There was no sign of recent infection and yet the woman died within seventy-two hours of a virulent peritonitis. It would be advisable to postpone operation in such cases for a considerable time after the injection has been made, at least until the patient had passed over a menstrual period without inflammatory pelvic symptoms. While Estes' plan of attaching the cut surface of the ovary to the cut surface of the uterine cornu has been successful, the proportion of favorable results must of necessity be small; for release of the ovum into the tube can only take place when the developing follicle is directly opposite to the lumen of the tube.

DR. J. C. HIRST, II, said in answer to Dr. Anspach, that the question of sterility depends on whether the tubes are closed at the outer or inner end. If at the inner end, the patient should know she has only a chance of one in eight or ten, and she should make the choice. In outer end it is about forty per cent. He had done eight or ten Estes' operations after which three or four of the patients complained quite bitterly of painful menstruation following. It is certainly not an ideal operation.

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#### Erratum

In the May issue of the Journal it was stated that Dr. Charles C. Norris was elected first vice-president of the American Gynecological Society. This was a mistake. Dr. Richard C. Norris was chosen first vice-president.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Selected Abstracts

### The Climacterium

Fothergill, W. E.: Disabilities of the Menopause. *The Practitioner*, 1925, cxv, 43.

The author discusses the organic and functional changes that take place during and following the menopause. Due to the diminution and cessation of ovarian activity there is a loss of physiologic balance, which, together with the subsequent gradual recovery, may extend over some three or four years.

There occur localized pelvic troubles such as atrophy, caruncles, infections superimposed upon atrophic changes, vulvitis, vaginitis, endometritis, and adhesions. A marked reduction in the size of the vaginal outlet may result in a dyspareunia.

Fibroids may give trouble due to lessened blood supply and may degenerate, causing hemorrhages, etc. Any form of genital prolapse is accentuated due to the loosening of the pelvic structures.

Any excessive bleeding demands careful examination for cancer of the uterine body, polypi, or fibroids (submucous). Where no lesion can be found medical treatment is instituted and if this does not suffice, radium may have to be applied or even supravaginal hysterectomy performed.

Most of the symptoms are bound up with the vasomotor system. Digestive disturbances, flatulence and constipation may appear. Insomnia, depression, irritability of temper, illusions of pregnancy are all symptoms which may occur.

Change coming at ordinary time is readily recognized. Women with late puberty have early menopause; women with repeated pregnancies have a late menopause. Surgical menopause is less severe in younger than in older patients.

If no physical explanation can be found for menopausal complaints the patient should receive no local treatment and the less said about the condition the better. Bowels should be kept open. Plenty of fresh air, exercise, rest, and strict moderation in food and drink prove beneficial. Thyroid extract is more useful during the diminution of bleeding preceding the menopause than after menopause.

ADAIR AND GROSE.

King, J. T., Jr.: Observations on the Menopause. 1. The Basal Metabolism after the Artificial Menopause. *Bulletin Johns Hopkins Hospital*, 1926, xxxix, 281.

From his study of the subject the author draws the following conclusions:

1. Pelvic operations upon women (bilateral oophorectomy, unilateral oophorectomy, hysterectomy) were found to cause no permanent change in the basal metabolism.
2. The basal metabolism following such operations does not differ significantly from either the Sage Institute Standards nor from figures taken on normal women under conditions identical with those under which the patients who had been operated upon were studied.

3. Observations upon normal women support the Sage Institute Standards in all groups which include a number of observations sufficient to be of significance.
4. There is a tendency to a substantial gain in weight in most cases after complete or partial oophorectomy.
5. Increase of body surface from deposition of fat is associated with a proportionate increase in basal metabolism.
6. Deposition of fat after oophorectomy is not due to alteration of basal metabolism. It is probably due to reduced vigor.

C. O. MALAND.

Wiesel, J.: *Vasalgias and Hypertonias in the Climacterium*. *Medizinische Klinik*, 1924, xx, 1274.

Among the important climacteric affections are the vasalgias—pain in the arteries and veins. The vessels chiefly affected are the carotids, the temporal arteries, the aorta and the arteries of the legs and feet. The large veins of the lower extremities are also sites of predilection. That the pain arises in the vessels is proved by examination; for even in the presence of hyperesthesia, pressure on the blood vessel produces so much pain that the patient cries out. This sensitivity is not found in arteriosclerosis.

The climacteric vasalgias are differentiated from intermittent claudication by the absence of periodicity, pallor, coolness of the skin and feeble or absent pulse. Vasalgias of the aorta are often confused with angina pectoris but the course of the vasalgias is usually as follows: The pains begin with the first menstrual disturbances of the climacterium. Then appear uncomfortable sensations in the cardiac region occasionally accompanied by tachycardia (not found in angina pectoris). The vasalgia attacks may occur without bodily exertion but readily occur after psychic disturbances. Palpitation, which is only rarely associated with dyspnea, is a late symptom. In some cases the vasalgias are associated with radiating pains. These attacks occur especially in the afternoon after a meal, after a change of temperature, while undressing or while washing with cold water. During the attacks there is a burning pain substernally but there is no precordial anxiety and no sensation of impending death. The women even during an attack are able to describe their symptoms. The attacks are of short duration.

The painful sensations in the fingers and in the toes belong to the vasalgias. In long-standing cases, paralysis of the vessels develops. The hands become dark red, feel warm, are edematous, and have a tendency to develop eczema and diseases of the nails.

According to the author, elevation of the blood pressure during the climacterium manifests itself differently from hypertension in other periods of life. In the former, at least in the early stages, the height of the blood pressure varies considerably from day to day but is dependent upon bodily exertion and psychic emotions. Patients with high blood pressure generally suffer from vasalgias and often the elevation of blood pressure coincides with an attack of pain not only in the cardiac region but also in other parts of the body. On the other hand, a high blood pressure may be the result of a universal contraction of the blood vessels. Attacks of paroxysmal elevation of blood pressure are associated with sensations of heat, headache, perspiration or dizziness. After the attack there is bradycardia and a high pulse pressure, just as is seen after an injection of adrenalin. The author emphasizes that the characteristic of the climacterium is not permanent hypertension but the fluctuation in the blood pressure at a high level. A further characteristic is the objectively demonstrable local or general constriction of blood vessels with subsequent elevation of blood pressure and bradycardia.

J. P. GREENHILL.



**Leconte, M.: Hypertension at the Menopause.** *Journal de Médecine de Paris*, 1925, No. 11, p. 221.

After studying the literature on the subject and a series of 308 cases of his own, Leconte concludes that the menopause, either physiologic or surgical, should take its place as a possible causative factor of hypertension. The underlying factor in these cases he attributes to either an abrupt or progressive disturbance of ovarian function. Further, he feels that this type of hypertension is well borne, carries with it very little danger of complications, and not rarely becomes alleviated or disappears of itself. Finally, with respect to organotherapy, he believes that such treatment if instituted early is often of great benefit. On the other hand, if considerable time has elapsed between the onset of the menopause and the inauguration of treatment, poor results are to be expected.

THEODORE W. ADAMS.

**Strassman, E.: Circulatory Changes due to the Climacterium and Castration, Especially in Myomata.** *Archiv fuer Gynaekologie*, 1925, cxxvi, 169.

The author finds an average increase of 20 mm. in the blood pressure during the normal menopause. In 15 to 20 per cent of the cases this leads to a cardiac hypertrophy followed by a secondary dilatation. He has coined the terms "climacteric blood pressure" and "climacteric heart" for these conditions. In cases of myomata, which do not bleed profusely, there is only a moderate difference in blood pressure until the menopause is reached when the increase is even more marked than in normal women. In those cases of myomata which bleed profusely, the blood pressure is low due to the hemorrhages. At least 40 per cent of the cases of myomata show a cardiac hypertrophy as compared with 18 per cent in normal women.

The size of the myoma plays no rôle in these circulatory changes. Removal of the tumors does not reestablish normal circulatory conditions. The fact that ovarian destruction through radiation results in atrophy of the myoma and the fact that the circulatory changes following myomata resemble those following the normal menopause, leads the author to conclude that myomata result from ovarian dysfunction which produces hypertonic changes in the circulatory system as well as in the uterus.

Shortly after castration by radiation or by total extirpation of the uterus and adnexa, there is an average drop in blood pressure of 19 mm. The drop following enucleation of myomata only averages 11 mm. The permanent effect of castration during the menstrual life on blood pressure is an average increase of 32 mm. systolic and 15 mm. diastolic. During the menopause, however, castration produces no definite effects upon the blood pressure which must prove that the internal secretion of the ovary is undisturbed by such a procedure. Deep x-ray therapy, on the other hand, does produce a rise in blood pressure so that only this type of radiation may be spoken of as true "Roentgen Castration."

The author concludes from these findings that the production of the menopause by means of radiation in "ovarian doses" is preferable to castration by either surgery or deep x-ray therapy because no circulatory or cardiac disturbances are thus produced. For the same reason the treatment of choice in cases of myomata without complications due to hemorrhage etc., is radiation.

RALPH A. REIS.

**Aschner, B.: The Harmful Late Results of Extirpation of the Uterus by Operation as Well as by Radiation.** *Archiv fuer Gynaekologie*, 1925, cxxiv, 113.

After careful follow-up studies in 104 cases in which hysterectomy with or without removal of the ovaries had been performed or castration had been produced either by radium or x-ray, the author concluded that such procedures are followed

by serious complications. Such complications are not only conditions arising from the "extirpation" per se but are actually diseases of autointoxication arising from the retention of the products of menstruation and are found in the majority of cases suffering from an artificial menopause. Aschner believes that the "excretory" function of the uterus is fully as important as the internal secretion of the ovary and that it is essential to the welfare of the patient that all therapy include the preservation of the uterus wherever possible in order that the patient may have the benefit of this excretory function. Hysterectomy should be performed, therefore, only for such serious conditions as carcinoma, sarcoma and tuberculosis where no other form of therapy is of value. Radium and x-ray therapy should never be used before the normal menopause has set in.

The serious after-effects following the destruction of the uterine function before the normal menopause include not only the vasomotor and circulatory disturbances, but such general conditions as obesity, plethora, metabolic dyscrasias and inflammatory diatheses. The various disturbances which the author has found resulting directly from such a suppression of the excretory function of the uterus, he lists as follows:

*Circulatory.*—Hypertension, flushes, parasthesias, telangiectases, external and internal hemorrhages, varicosities, hemorrhoids, arteriosclerosis, angina pectoris, true and false, etc.

*Nervous.*—Excitations, insomnias, palsies, headaches, sense of pressure in the head, vertigo, lethargy, neuritis especially sciatica, convulsions, etc.

*Mental.*—All types of mental disturbances including mania and melancholia.

*Skeletal.*—Gouty diatheses, all types of arthritic disturbances without definite pathology.

*Special Senses.*—Glaucoma, cataract, detachment or hemorrhage of the retina, tinnitus, otosclerosis, deafness, Ménière's disease, etc.

*Skin.*—Eczemata, skin tumors, inflammatory conditions.

*Special.*—Gallstones, diseases of the lungs and bladder.

For all the above conditions there is a general as well as a local treatment which must be directed towards the regulation of the excretory function of the uterus. This latter must be aided by such means as will aid the general metabolic processes and includes such measures as sweats, hydrotherapy, baths, stimulation of the skin, venesections, and the use of alterants and resolvents. The most important therapeutic measure, of course, is the prevention of such conditions by the adoption of conservative methods in uterine surgery, the preservation of uterine function whenever possible and the prevention of an artificial menopause.

RALPH A. REIS.

Menge: Arthropathia Ovaripriva. Zentralblatt für Gynäkologie, 1924, xlviii, 1617.

Early in his observations of the action of ovarian radiation, his attention was drawn to a form of arthritis most frequently found in the knee, less frequently in the shoulder, occasionally in the fingers and occasionally in the neck. In the case of one knee being affected, the other knee was always later affected, though not always to the same degree. Bilateral symmetry was characteristic of the disease. The joint was not altered in size or contour, but when the hand was laid upon the joint and active or passive movement undertaken it gave a sensation of roughening of the articular surfaces of the joint.

The subjective pain was slight. Occasionally there was a complaint of slight stiffness, although the limitation of movement was scarcely perceptible. An ir-

regularity in the joint could be perceived even in the absence of pain or stiffness. Some patients complained of considerable pain and difficulty of locomotion. In severer types, noise due to the roughening of the joint was perceptible to the ear. The affection usually disappeared spontaneously, but occasionally remained for years. Menge first considered these conditions a coincidence but later saw in them a definite arthritis with a causal relationship to radiation. A similar condition found relatively frequently among women at the time of the menopause, gave him the idea that the cause of the joint alteration lay in the arrest of ovarian function, hence the name "arthropathia ovaripriva."

Menge had awaited a chance for histologic examination of the affected joints before publication of his observations but was anticipated by Heidenhain's article on "Arthritis senilis bilateralis symmetrica."

Mention is made of a further condition, neuralgia due to loss of ovarian function, susceptible in many cases to treatment by baths. The pain frequently in association with myoma of the uterus near the climacteric is probably metabolic in origin rather than due to pressure. LITTLE.

Cecil, Russell, and Archer, Benj.: Arthritis of the Menopause. *Journal of the American Medical Association*, 1925, lxxxiv, 75.

Arthritis of the menopause is a definite clinical syndrome and is one of the most frequent types of arthritis encountered; approximately one-third of all arthritides of the female fall into this group. It is a chronic polyarthritis of the obese, middle-aged woman, occurring at or just after the menopause and is characterized by persistent stiffness and pains in the joints affected. It is of noninfectious origin. The disease runs a mild chronic course. Apparently it is a form of hypertrophic or proliferative arthritis. The knees are the joints most frequently involved, but fingers, shoulders, feet and lumbar spine are often implicated. The first symptom is a slight stiffness and pain in the knees, noticed when ascending or descending stairs or on rising from a chair. Patients seldom resort to crutches and never become bedridden. On flexion of the knees a certain amount of crepitation is usually detected. Actual limitation of the joint is rare. It is of interest to know that a large number of patients had previously been deprived of all their natural teeth by physicians who hoped to relieve the arthritis by such measures. Under the regimen of iodide, diminished carbohydrate diet and heat treatment in all of its forms, the majority of the patients have been benefited. The results with ovarian extract or whole substance were nil. GROVER LIESE.

Flatau and Herzog: Studies of Colpodystrophia Postclimacterica. *Archiv für Gynaekologie*, 1926, cxxvii, 113.

The authors discuss the pathology and histology of colpitis vetularum and show by means of three colored microphotographs that this name is a misnomer for this condition as there is no evidence of any inflammatory changes. These senile atrophies which take place in the vagina closely resemble the senile forms of eczema especially histologically. The authors treat this condition, which they call colpodystrophia postclimacterica, by means of ointments such as Lassar's paste, xeroform 3 per cent or dermatol 1 per cent or salicylic acid 3 per cent. They suggest, as a future treatment, homoplastic transplants of young, healthy ovaries.

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